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III. *On the Origin of the prevailing Systems of Phyllotaxis.* *By the Rev.* George Henslow, *M.A., F.L.S., F.G.S.*

(Plate IX.)

Read February 4th, 1875.

Introduction.—In my paper "On the Variations of the angular divergences of the Leaves of *Helianthus tuberosus*" (Trans. of the Linn. Soc. vol. xxvi. p. 647), the concluding paragraph commenced as follows:—"If we limit our inquiries to the conditions of the primary [ordinary fractional] series alone, we find, as a fact in nature, that if we assume any leaf as No. 1, then No. 2 lies at an angular distance from it, between 120° and 180° inclusively. If we ask why it is so, no answer can be given. Further, starting with this condition, we find the second leaf has an inherent tendency to take up a definite point as its position along that arc. . . . . If we ask why it is so, or why the second leaves are not *anywhere* upon that arc, there is as yet no answer to this question any more than to the first."

In the present paper I propose endeavouring to reply to both these questions, and to expound what appears to me to be the fundamental origin of the various systems of phyllotaxis exemplified in nature.

The Spiral arrangement is deduced from Opposite and Decussate Leaves.—If a stem (as of the Jerusalem Artichoke) be found having opposite and decussate leaves from the base upwards, but becoming converted into an alternate and spiral arrangement above (a not uncommon feature), the first process of such a change is the development of short internodes, so as to separate the leaves of each opposite pair, as in fig. 1. The numbers represent the leaves, which are supposed to occupy their original decussating positions. *The order of the numbers* shows the true spiral arrangement now produced by this development of new internodes, and which are indicated by the thin lines, while the original and long internodes are represented by the thicker portions of the spiral.

In other words, if a line be drawn from leaf to leaf successively, it will be spiral, and will pass through the leaves in the order indicated by the numbers on the projected helix (fig. 1). (*See note*, p. 45.)

In following up this spiral line, it will be seen that just those numbers which are the denominators of the fractions of the usual (primary) series, $\frac{1}{2}$, $\frac{1}{3}$, $\frac{2}{5}$, $\frac{3}{8}$, $\frac{5}{13}$, $\frac{8}{21}$, fall over one another, viz. 0, 5, 8, 13, 16 [$=2\times8$], and 21. Similarly the number of coils of the helix between 0 and each of these numbers successively supplies the numerators. Thus there are *two* coils between 0 and 5; *three* coils between 0 and 8; *five* coils between 0 and 13; and lastly, *eight* coils between 0 and 21.

The denominators of the first two fractions (2 and 3) are not represented amongst these numbers; the reason for this will be explained further on.

In the diagram the leaves are represented as retaining their originally decussating positions; but practically, while the internodes are being developed, the leaves *shift their positions*, as it were, and obey the following law:—

The angular distance between any two successive leaves, when projected on the same horizontal plane, is constant.—The rationale of this law seems inexplicable, because we cannot say what causes a leaf to grow out of the axis of a bud at one particular point rather than another. All that can perhaps be suggested is, that as an equable distribution of light may be thus presumably acquired by every leaf, so natural selection may have been a determining influence; but there would seem to be no grounds for assuming external influences to have been the *sole* originating causes *. Whatever be the ultimate facts which cause the position of leaves to be what it is, they cannot in the present state of our knowledge be determined †.

This law is found to be true both for normally alternate leaves and for those which have arisen on a stem by the development of internodes, on which the lower leaves were opposite or whorled in threes. The following observations are the author's, and quoted from the paper alluded to above (p. 654):—

"A change from verticils of threes into $\frac{2}{7}$ was frequent. It takes place in the following manner:—The first step is to cause the three leaves of the different whorls to separate slightly by a development of their internodes. Then, if any two consecutive whorls be examined, the order of succession of the six leaves (No. 1 being the lowest leaf) is thus,—

6

3 2

7 9

8

4 5

1

in which it will be noticed that the 4th leaf, instead of being over the interval between the 1st and 2nd, is over that between the 1st and 3rd; so that the angle between the

* The 'Text-Book of Botany,' by Sachs (translated by A. W. Bennett), p. 179, may be here consulted.

† Mr. Hubert Airy has started the proposition that "leaf-arrangement exists for and is determined in the bud." And his "condensation theory" of leaf-arrangement depends upon "the contact among the balls which [he] uses to represent embryo leaves." ('Nature,' vol. vii. p. 442.)

I venture to call in question both of these fundamental conditions of his theory.

That plants generate their buds during a short summer in readiness for the first sufficiently warm weather in spring is an obvious fact; but that they should be obliged to keep the buds so long undeveloped is no fault of theirs, but a circumstance dependent upon climate. When once a bud is made, and the only opportunity is the comparatively short time the plant is in leaf, it matters not whether it remain a week, a month, or six months. The duration can have nothing to do with the formation of it, or of the importance of any peculiar leaf-arrangement.

If, however, we substitute *vernation* for leaf-arrangement (as synonymous with phyllotaxis), it will be perfectly true; for the half-formed leaves are folded in various ways, so as to to render the bud as compact as possible. Moreover there is nothing in the structure of buds to justify the comparison of embryo leaves to balls. They are not balls at all, but, rather, conical with more or less *flat surfaces*. Although the apex of a leaf may first appear as a hemisphere, it does not retain that form, but elongates into a cone by the time the next leaf emerges from the axis;

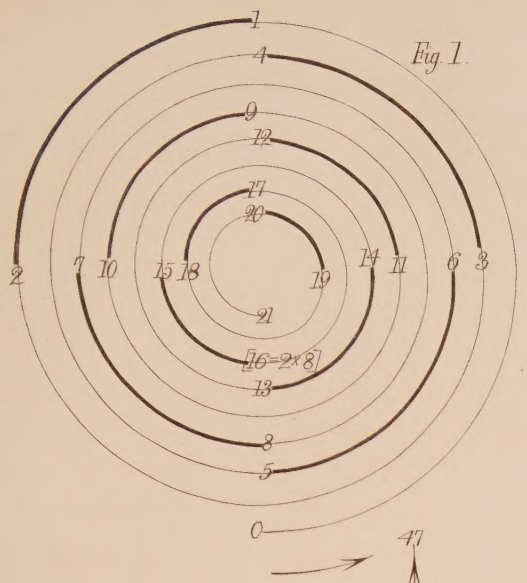

Fig. 1.

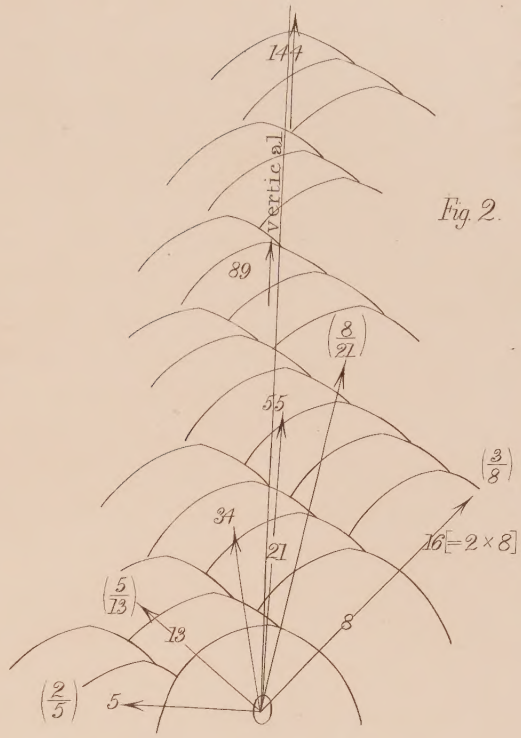

Fig. 2.

Fig. 3.

G. Henslow del.

G. Jarman sc.

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1st and 2nd leaves, or between the 2nd and 3rd, is *double* that between the 3rd and 4th. These latter, it will be remembered, are separated by a long internode. The same order obtains with the succeeding whorls; the nodes, however, are now much more widely separated, while a true spiral arrangement, with the same and constant angular distance between all its leaves, is ultimately secured, and is henceforth continued uninterruptedly into the terminal bud, and represented by the fraction $\frac{2}{7}$."

An exactly analogous process takes place with opposite leaves in passing, for example, into the $\frac{2}{5}$ arrangement. Internodes are, of course, developed; and the leaves of the first few pairs that are separated from each other have not, if projected, an equal or correct angular distance of 144° between them successively; but just as in the production of the $\frac{2}{7}$ spiral arrangement from whorls of threes, so is it here—that as the $\frac{2}{5}$ plan is continued up into the terminal bud, the leaves "right" themselves, as it were, and then ultimately come to obey this law accurately by securing a constant angular divergence. Fig. 140, on p. 168 of Sachs's 'Hand-book' mentioned above, illustrates this fact, though that author has not detected the significance in the order of development of the leaves.

The origin of Cycles.—It will be gathered from the foregoing remarks and from fig. 1 that *a cycle is formed from a definite number of pairs of decussating leaves.* Thus, if opposite leaves give rise to the $\frac{2}{5}$ arrangement, then the three pairs (0, 1) (2, 3) (4, 5) are required to produce the first cycle. Having once, as it were, "started" it, the subsequent leaves are developed in accordance with the above law, the angular divergence between every two consecutive leaves being 144°. Similarly, if opposite leaves pass into the $\frac{3}{8}$ arrangement, then, in addition to the first three pairs, two others (6, 7) (8, 9) are required; so that if the first cycle embracing leaves 0 to 7, inclusive, be secured, the subsequent leaves are developed according to the same law, requiring, however, 135° as their constant angular divergence.

Hence it appears that while some plants have taken *three* pairs of the originally decussating leaves to form a cycle, *i. e.* of the $\frac{2}{5}$ arrangement, other plants have required *five* pairs, others *seven*, while cones frequently demand *eleven* pairs; so that the 21st leaf, or the first of the second cycle, falls over that of the first cycle, or that indicated in the figure as 0.

Here, again, it does not seem possible to say why one plant, or even part of a branch, should thus convert a definite number of pairs of opposite and decussate leaves into a cycle of some alternate arrangement. We can conceive of nature distributing the leaves of all plants in which they are alternate simply and solely in accordance with the law given above, while it might have remained indifferent as to the precise amount of the angular divergence. As a matter of fact, however, this angle is determined by the

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and the fact that *the point of emergence* is determined, so to say, from *within* the axis before the leaf is formed seems fatal to the condensation theory.

Again, Mr. Airy takes no account of stipules, which according to his theory ought to interfere materially in leaf-arrangement, because, if not petiolar (as in Rosaceæ) they rise from the axis exactly like leaves, and may even, as in the Elm and Lime, grow to as much as four times the size of the leaf to which they belong. Hence with, say, two minute leaf-apices and four subglobular or, what would be more true to nature, conical stipules, we may ask, What becomes of the "contact theory" when the subsequent development proves that the leaf-arrangement has not been interfered with?

number of leaves constituting a cycle, which cycle has itself been determined by the number of pairs of leaves of the originally decussate arrangement.

It may be again observed that when numbers of the "secondary" series, viz. $\frac{1}{3}$, $\frac{1}{4}$, $\frac{2}{7}$, $\frac{3}{11}$, &c., occur, as in the Jerusalem Artichoke, they do so from an analogous process arising out of whorls of threes. Further, in tracing the phyllotaxis of plants of palæozoic ages, it appears that, besides representatives of the usual or primary and secondary series, some instances occur (as in species of *Lepidodendron*) which have resulted from the breaking-up of whorls of fours, giving rise to the tertiary series $\frac{1}{4}$, $\frac{1}{5}$, $\frac{2}{9}$, &c.; while even a quaternary series, $\frac{1}{5}$, $\frac{1}{6}$, $\frac{2}{11}$, &c., finds a representative in *Knorria taxina*, the phyllotaxis of which is said to be $\frac{5}{28}$ *. At the present day, however, any other than the primary series is comparatively rare.

Correlation between Internodes and Angular Divergences.—If a stem grow rapidly, or at least develop internodes of considerable length (as is the case with the Jerusalem Artichoke), the fraction representing the subsequent arrangement of the leaves upon it will be a "low" one of the series. If, however, the internodes be very short, then, conversely, the leaves or their equivalents will be represented by one of the higher fractions, such as $\frac{5}{13}$, $\frac{8}{21}$, $\frac{21}{34}$, &c., as is well seen in cones, involucres, &c. There appears at present to be no better explanation of this correlation than the one already alluded to, namely the object of avoiding interference of one another. This, however, the author is inclined to regard as a distinct factor in the causes which regulate leaf-arrangement. It will be easily seen that if leaves are on the $\frac{2}{5}$ plan, with very short internodes, the 6th leaf *will lie immediately upon the surface of the first*, what would be called "opposite" in flowers, especially if the leaves be sessile; but if they be on the $\frac{5}{13}$ or, better still, $\frac{8}{21}$, then the 14th or 22nd leaf will be freer from the first, as seen in the scales of a cone.

The Divergence $\frac{8}{21}$ determines all higher ones of the primary series.—In fig. 1 it will be seen that the following numbers occur in the same vertieal line,—0, 5, 8, 13, 16 [$= 2 \times 8$], and 21. Or, if written thus, 0, 5, 5 + 3, 8 + 5, 13 + 3, 16 + 5, &c., the numbers can easily be ascertained to any height required. If this be done, it will be discovered that the numbers 34, 55, 89, 144, which form the denominators of the fractions higher than $\frac{8}{21}$, do not fall in this same vertical line; and the question might be asked, on the supposition advanced in this paper, how it ever happens that higher fractions than $\frac{8}{21}$ are represented in nature. The reply is, that while the numbers 5, 8, 13, and 21 give rise to the divergences $\frac{2}{5}$, $\frac{3}{8}$, $\frac{5}{13}$, and $\frac{8}{21}$ respectively, yet this last, $\frac{8}{21}$, *supplies all the higher fractions.* That is to say, if the spiral arrangement represented by $\frac{8}{21}$ be projected as a helix, and the numbers noted down, to (say) the 90th leaf, then the 34th, 55th, and 89th leaf *will be found lying nearest to the vertical line*, alternately right and left of it, while each of these leaves approximates nearer and nearer to it respectively, as will be seen by referring to fig. 2. Moreover, as the initial leaves of successive cycles of arrangement represented by the fractions $\frac{8}{21}$ and higher ones, cannot be in a truly vertical line, it becomes often difficult to fix upon the leaf most nearly vertical; in fact it is almost, if not quite, arbitrary whether we select the 34th, 55th, or 89th leaf. We may go further, and say that the discovery or proof of a gene-

* Alluded to in Prof. Balfour's 'Palæontological Botany.'

rating spiral for any higher than $\frac{3}{8}$ is impossible; or perhaps it would be better to say that, for any other arrangement than those represented by the fractions $\frac{1}{2}$, $\frac{1}{3}$, $\frac{2}{5}$, and $\frac{3}{8}$, the phyllotaxis is more or less uncertain, and the idea of a definite or *exact* generating spiral becomes more or less evanescent. In the latter case the reason for hesitating to pronounce which is most nearly vertical over the first selected, arises from the fact that neither the axis nor the leaves or scales are ever developed with mathematical accuracy, notwithstanding the fact that the position of the leaves may be mathematically projected.

It will, then, be seen how all apparently higher arrangements than $\frac{8}{21}$ are due to *that* divergence itself; for this is the highest that can be determined from opposite leaves *.

Moreover, to say that the angular divergence represented by $\frac{8}{21}$ furnishes all the higher ones, is, to some extent, if not inexact, yet a somewhat incomplete statement; for in certain cases $\frac{5}{13}$ has the same effect, since this fraction is also irrational to the circumference. Thus in some cones of the Scotch Fir, while the 13th scale is very nearly over the first, even the 34th leaf may not be far from the same vertical line, and so render it doubtful as to which fraction may best represent the phyllotaxis. However, it must be remembered that no higher denominator than 21 can be secured from opposite leaves, as stated above and shown by fig. 1.

The reason why $\frac{8}{21}$ is the most usual kind of phyllotaxis with closely compacted scales seems due to the fact that *it forms the nearest approximation to the alternation of whorled leaves*, only *one row* of scales lying between those containing Nos. 0 and 21 respectively.

Theoretical considerations.—Of course it is here only advanced as a theory that nearly *all* spiral arrangements of Dicotyledons, at least, have been originally derived from opposite leaves; for although they have such in the cotyledons of their embryos, yet the very first leaves of the plumules (as is well seen in a germinating acorn) at once assume their own peculiar spiral arrangement. Yet at the same time it must be remembered that the theory is founded upon the fact that when a branch has opposite leaves below and alternate above, the latter *are* developed according to the law expressed in fig. 1.

The law of embryology, that a member of a higher grade passes in its *embryonic* state through the conditions of a lower grade when in its *adult* state, would seem to hint at this being at least probable, and that opposite leaves were probably the original and normal state of the primogenitors of dicotyledonous angiosperms.

Moreover, when we remember that whorled leaves were apparently very frequent in the carboniferous epoch, and that instances of symmetrical reduction are common amongst plants, *e. g.* in the floral whorls of *Circæa* as compared with *Epilobium* (in which

* It may be said on *à priori* grounds that the failure of the theory in deducing any higher fractions than $\frac{8}{21}$ from opposite leaves is unfavourable to its acceptance; but it must be remembered that no theory is to be tested by what may be imagined it should account for, but by what it *does*. Now this theory, the author maintains, does account for all that is necessary; and any assertion that $\frac{13}{34}$ and higher fractions *ought* to arise *directly* out of opposite leaves is a merely subjective impression not necessarily requiring to be correlated with any objective fact. If they can be satisfactorily accounted for, as the author maintains they can, as stated, from the $\frac{8}{21}$ arrangement, then all that is required has been done.

latter genus, it may be observed in passing, there is a frequent change from opposite to alternate leaves), that the numbers 'fours,' 'fives,' and 'sixes' are often found amongst the whorls of the flowers on the same Jessamine, Elder, Rue, &c., and, again, that there is the positive fact of opposite and whorled leaves passing into spiral on the same stem, as in *Epilobium*, there would thus seem to be a just inference that the great majority of instances of spiral phyllotaxis have taken their origin from whorled and opposite arrangements.

Opposite Leaves generally fail to produce the $\frac{1}{2}$ *and* $\frac{1}{3}$ *arrangements.*—On referring to the figures of the diagram (fig. 1), it will be seen that for decussate leaves to become spiral and *distichous* (that is, to be represented by the fraction $\frac{1}{2}$) the third leaf, No. 2, must, as it were, pass through 90° in order that it may fall over the first (or 0). Similarly if decussate leaves were to pass into the spiral arrangement represented by $\frac{1}{3}$, *i. e.* to become *tristichous*, the fourth leaf, No. 3, must fall over the first. In all other cases the leaves have to shift through a much less angle than 90°. This may be the reason why $\frac{1}{2}$ and $\frac{1}{3}$ are by no means common amongst Dicotyledons. On the other hand, they appear *particularly* frequent amongst Monocotyledons. The above failure in producing the $\frac{1}{2}$ and $\frac{1}{3}$ arrangements is on the supposition that the spirals result from the conversion of a definite number of *pairs* of opposite leaves. On referring, however, to fig. 1, it will be seen that if leaf (0) be neglected, and No. 1 represent the first leaf, then the 4th is actually over the 1st, and thus will give rise to the $\frac{1}{3}$ plan. This may have been the origin of the tristichous arrangement amongst Dicotyledons, as well as of the ternary symmetry which occasionally occurs in the flowers of that class; but it is comparatively rare in both leaves and flowers; and this seems to correspond with the fact that it is usual to convert *complete pairs* into alternate leaves. As an additional fact it may be mentioned that other rare arrangements, such as $\frac{4}{11}$, $\frac{7}{11}$, $\frac{11}{29}$, &c., which occasionally occur in nature, can be deduced from it, and lend proportional aid to the acceptance of the theory. This will be better seen by referring to the scheme appended to this paper (fig. 3).

Before suggesting a cause for this latter fact, it would be as well to state that, in every case that I have examined, wherever leaves have to be represented by $\frac{1}{2}$ in Dicotyledons, I believe it is an effect produced by habit of growth resulting in an apparent production of the $\frac{1}{2}$ or $\frac{1}{3}$ arrangement. Thus, if the leaves on a shoot of Ivy growing against a wall be compared with those on a free (barren) branch, or the leaves of the common Yew with those of the "fastigiate" variety—or, again, comparing the leaves on a horizontal bough of the common or Portugal Laurel with those on a shoot growing freely upwards, it will be seen at once how the usual and really or apparently distichous arrangement reverts to the manner of growth represented by $\frac{2}{5}$ or $\frac{3}{8}$, thereby revealing the fact that in those (and probably all other) instances the leaves were not originally distichous, but have only acquired that arrangement by habit.

I have, indeed, reason to suspect that it is only in those instances where the leaves of a branch lie in one and the same horizontal plane, from a peculiar habit of growth, that the $\frac{1}{2}$ and perhaps $\frac{1}{3}$ arrangement occurs, and that this obtains mostly in a certain number of instances, where the leaves are broad and not dissected; for deeply gashed or com-

pound leaves, as in the May and Ash, permit the ingress of light and air, so that a "higher" spiral divergence is permissible, in that the leaves need not all be brought to the surface of the tree.

As other examples of these divergences, may be mentioned the Alder, Lime, and Elm, the first of these being usually regarded as having its leaves arranged on the $\frac{1}{3}$ plan. This may also be due to peculiarity of growth, especially as the scales of both male and female catkins (of the Alder) are on the $\frac{3}{8}$ plan.

Again, if it be noticed how the Lime and Elm spread out their leaves on horizontal planes, just as in the case of the garden-Laurel, the influence of light &c. already alluded to can be supposed to some extent able to have induced this arrangement; how far, however, it is impossible to say; for although light will cause fully developed leaves to turn to it, we do not know if it can cause a leaf to grow out at a particular point on the axis of the bud, so as to secure a more favourable position as regards the light, in *anticipation*, as it were, of its adult state. It is obvious that, of such broad leaves as these trees possess, if they were grouped spirally round the branch, some would fall underneath in the shade of the others, whereas by being, as they are, on the same horizontal plane, they all become equally favoured.

Hence has arisen, as I believe, these distichous and, so to say, pseudo-distichous * and tristichous arrangements, which are by no means common amongst Dicotyledons †.

Having now seen that, whenever *distichous* and *tristichous* leaves are found amongst Dicotyledons, they may most probably be regarded as *not* issuing directly from opposite leaves, it may be observed, on the other hand, that these arrangements are particularly characteristic of Monocotyledons, as in *Iris*, orchids, grasses, &c. To ascertain a cause for this, let us again go to the embryo. Here we have but a single cotyledon. Now it must be observed that, for any arrangement of the usual or primary series, no portion of a spiral which when projected constitutes a circle ever contains more than three leaves; or, with the exception of the distichous, such a circle *always does* contain three leaves. It will be at once seen that the distichous and tristichous, or the $\frac{1}{2}$ and $\frac{1}{3}$ plans, are the only kinds which admit of *one complete cycle* being projected in a circle. In the former the leaves are at opposite extremities of a diameter, in the latter at an angular distance of 120°. Hence there are these two methods of equalizing the distance between the leaves, and at the same time securing a cycle and satisfying the laws already stated.

Thus, then, we may perhaps be able to account for the fact that $\frac{1}{2}$ and $\frac{1}{3}$ do frequently represent the leaf-arrangements amongst Monocotyledons. On the other hand, the conspicuous absence of arrangements represented by $\frac{2}{5}$ and higher fractions is a significant fact affording negative evidence of great value.

* I make the distinction between *distichous* and *pseudo*-distichous, to indicate the fact that in some cases, as in the Yew and *Taxodium*, the leaves are only apparently distichous in consequence of a twist in the petioles—a result more easily conceivable to be due to light than the truly distichous arrangement, as in the Laurel and Beech, in both of which the leaves or vertical shoots often revert to higher spiral arrangements.

† I take this opportunity of remarking that while examining the buds of these trees, I think I have discovered the cause of their unsymmetrical development—namely, that it is due to the position of the stipules, which lie obliquely across the two edges of the folded (conduplicate) leaf, thereby allowing one margin to develop more freely than the other. The bud-scales in both Elm and Lime are stipules.

The relative Ages of the classes Dicotyledons and Monocotyledons.—If any thing as to the relative ages of these classes can be argued from the foregoing facts, it would seem that Monocotyledons are of greater antiquity than at least angiospermous Dicotyledons, in that they furnish differentiated stages of leaf-arrangement issuing from an arrested condition of the embryo—that is, on the assumption of whorled leaves having preceded opposite, and opposite alternate, and that the single cotyledon of a monocotyledonous embryo has resulted from the arrest of another *. The fragmentary character of many monocotyledonous groups, as witnessed by a greater proportion of isolated orders and genera † than in angiospermous Dicotyledons, as well as the very general prevalence of albumen (excepting water-plants), *i. e.* a retention of an embryonic character, may be brought forward as reminders that other facts corroborate this idea; while, as far as the scanty evidence of geology can take us, Monocotyledons seem to have been represented in the primary epoch (though some palæontologists contest this), yet no instance of an angiospermous Dicotyledon has yet been forthcoming from the same period.

Explanation of the Scheme (*fig.* 3).—In this scheme are represented the relative positions of the leaves of the ordinary phyllotaxis. The figures connected by double lines are those which give rise to the fractions

$$\tfrac{2}{5},\ \tfrac{3}{8},\ \tfrac{5}{13},\ \tfrac{6}{16}\ [=\tfrac{3}{8}],\ \tfrac{8}{21},\ \tfrac{13}{14}.$$

* In suggesting this process of reduction from whorled leaves as the origin of opposite in Dicotyledonous embryos, and of a single cotyledon in Monocotyledons, I may seem to differ somewhat from Mr. Herbert Spencer's views expressed in his 'Principles of Biology,' vol. ii. p. 67, where he conceives of both Dicotyledons and Monocotyledons as diverging from a common ancestral type, the former having the first two folial or thalline organs flattened out in virtue of the requirement of strength by a development of the midrib, which therefore does not necessitate their being rolled into the form of a cylinder to acquire strength, as in Monocotyledons; and, secondly, to use his own words, "if we assume, as the truths of embryology entitle us to do, an increasing tendency towards anticipation in the development of subsequent fronds—if we assume that here, as in other cases, structures which were originally produced in succession will, if the nutrition allows and no mechanical dependence hinders, come to be produced simultaneously, there is nothing to prevent [a passage from an alternate to an opposite condition in the development of the first two thalline or folial expansions]."

If this "assumption" simply means "arrest" of the internode of the second frond, he is probably right, as it appears obvious that an alternation is acquired solely by the development of an internode. But the process of such internodal development appears rather to be due to the presence of extra nourishment and rapid growth, than the reverse, as seems to be implied by Mr. Spencer; for his words intimate that nutrition must determine the opposition rather than the alternation. But I cannot help thinking that neither nutrition nor the want of it is the *vera causa.* They may determine more or less the *growth* but not the *development.* It is to me inconceivable how mere physical causes could have produced, for example, the fundamental distinction between an exorhizal dicotyledonous axial root and the endorhizal character of monocotyledonous adventitious roots—a feature which Mr. Spencer does not appear to have considered, and which is really due to the arrest of the primary or axial root in the latter, and which is therefore correlated with an arrested cotyledon; and, it may be added, an arrested condition is the presence of unconsumed endosperm, so general in all terrestrial Monocotyledons.

Hence I conclude that an alternate or spiral arrangement in Dicotyledons results from the *development* of internodes, but in Monocotyledons in consequence of the *arrest* of one cotyledon.

† I find from a calculation of the orders and genera given in Le Maout and Decaisne's 'Descriptive and Analytical Botany,' edited by Dr. Hooker, that of Monocotyledons about 60 per cent. of the orders comprising that subkingdom have less than 6 genera, and nearly 33 per cent. have less than 3 genera; whereas of Monochlamydeous exogens, omitting Gymnosperms, there are about 40 per cent. of orders with less than 6 genera, and 26 per cent. with less than 3. Lastly, of Dichlamydeous exogens, there are no more than 28 per cent. of orders with less than 6 genera and about 15 per cent. with less than 3.

No. 34 is placed vertically over 0. Strictly, however, this should be slightly to the left of the vertical line (but it would be inconvenient to allow for deviations due to minutes and seconds); for since 34 is not rational to the circumference, or a measure of 360, that leaf could never fall absolutely vertically over the first (0).

The scheme may therefore be considered as approximately representing the $\frac{13}{34}$ plan.

The figures connected by single zigzag lines are those which give rise to the series

$$\tfrac{1}{3}, \tfrac{3}{8}, \tfrac{4}{11}, \tfrac{6}{16}\ [=\tfrac{3}{8}], \tfrac{7}{19}, \tfrac{9}{24}\ [=\tfrac{3}{8}], \tfrac{10}{27}, \tfrac{12}{32}\ [=\tfrac{3}{8}], \tfrac{13}{35}, \text{\&c.}$$

and which, as has been shown, are deducible from opposite leaves by omitting the lowest or first.

There are several other fractions which represent the angular divergences of leaves occasionally met with in nature, but which have hitherto not been referred to any phyllotaxis.

Thus Hofmeister, in his 'Handbuch der physiologischen Botanik,' mentions the following:—

$$\tfrac{3}{7}, \tfrac{4}{11}, \tfrac{7}{11}\ (\tfrac{7}{18}), \tfrac{7}{20}, \tfrac{11}{31}, \tfrac{14}{31}, \tfrac{18}{47}\ *.$$

He endeavours to show how these *may* be derived from fractions of the ordinary series by a slight decrease or increase of the angular divergence, thus:—

$$\begin{aligned}
\tfrac{3}{7} &= \tfrac{2}{5} + \tfrac{1}{35} \text{ or } = \tfrac{1}{2} - \tfrac{1}{44}\\
\tfrac{4}{11} &= \tfrac{3}{8} - \tfrac{1}{88} \text{ or } = \tfrac{1}{3} + \tfrac{1}{33}\\
\tfrac{7}{11} &= \tfrac{5}{13} + \tfrac{1}{234} \text{ or } = \tfrac{2}{5} - \tfrac{1}{90}\\
\tfrac{7}{20} &= \tfrac{2}{5} - \tfrac{1}{20} \text{ or } = \tfrac{1}{3} + \tfrac{1}{60}\\
\tfrac{11}{31} &= \tfrac{2}{5} - \tfrac{7}{155} \text{ or } = \tfrac{1}{3} + \tfrac{2}{93}\\
\tfrac{14}{31}\dagger &= \tfrac{1}{3} + \tfrac{2}{93} \text{ or } = \tfrac{1}{2} - \tfrac{3}{62}\\
\tfrac{18}{47} &= \tfrac{13}{34} - \tfrac{1}{1598} \text{ or } = \tfrac{5}{13} + \tfrac{1}{611}.
\end{aligned}$$

To these may be added $\frac{7}{19}$ and $\frac{11}{29}$.

Now, of these, $\frac{4}{11}$, $\frac{7}{19}$, $\frac{7}{20}$, $\frac{11}{29}$, and $\frac{11}{31}$ can be more easily obtained from the new series, commencing $\frac{1}{3}$, $\frac{4}{11}$, &c., as given above.

For $\frac{4}{11}$ and $\frac{7}{19}$ result immediately from opposite leaves when the lowest leaf is neglected. Now $\frac{7}{20} = \frac{4}{11} - \frac{3}{220}$, and therefore differs from $\frac{4}{11}$ by a much smaller fraction than from $\frac{2}{5}$ or $\frac{1}{3}$. Again $\frac{11}{31}$ differs from $\frac{4}{11}$ by only $\frac{3}{341}$.

So that while of the above anomalous fractions $\frac{3}{7}$, $\frac{7}{11}$ (which is simply the *reverse* of $\frac{7}{18}$), and $\frac{18}{47}$ are deducible from some number or other respectively of the usual series, $\frac{4}{11}$, $\frac{7}{20}$, $\frac{11}{31}$, and also $\frac{7}{19}$ and $\frac{11}{29}$, are to be obtained by starting with $\frac{4}{11}$, which, in turn, is directly obtainable from opposite leaves ‡.

* Excepting $\frac{14}{31}$, these are indicated on the scheme by means of arrows.

† This fraction $\frac{14}{31}$ I cannot account for, unless it approximates the *reverse* of some other; otherwise it cannot belong to the usual series, as there must be always 3 leaves in every projected circle of a cycle; consequently 14 appears to be too high a number (of cycles) for 31 leaves.

‡ Since this paper was in type I have met with a curious exception in *Lagerströmia*, in which the order of the leaves, instead of forming a spiral, "oscillate" through three quarters of a circle. The first four leaves succeeding the opposite are as in fig. 1; but the subsequent arrangement is as follows—0, 1, 2, 3, 5, 4, 7, 6, 8, 9, 10, 11, 13, 12, 15, 14, 16, 17, 18, 19, 21, 20. This, perhaps, may prove to be the clue to the origin of distichous leaves amongst Dicotyledons.

IV. *On the* Barringtoniaceæ. *By* John Miers, *F.R.S., F.L.S., Dignit. et Commend. Ord. Imp. Bras. Rosæ, &c.*

(Plates X.–XVIII.)

Read June 3rd, 1875.

THE *Barringtoniaceæ* form an extremely natural group, offering very distinct and uniform characters; they differ from the *Myrtaceæ* in their alternate leaves without pellucid dots, in another kind of inflorescence, and in a fruit of very different structure. The *inflorescence* is either terminal and thyrsoid, with several approximated flowers, often of extraordinary dimensions, fixed upon a thick erect terminal stem, or more generally consisting of smaller flowers, spicately arranged upon long terminal pendulous racemes, sometimes subaxillary, or more rarely in branching panicles; but in all cases the flowers are formed upon one uniform plan.

The leading character of this floral structure is, that their very numerous long slender stamens, in many series, are united at their base into a shortish erect monadelphous tube, seated on the outer margin of a horizontal annular epigynous disk, from which they all fall off together, thus differing essentially from the *Myrtaceæ*, where the similar stamens are always free, each seated independently upon a perigynous annular disk, from which they fall off separately, leaving upon it many cicatrices, marking the several points of their previous attachment upon it. There is little analogy in this respect with the structure of the *Lecythidaceæ*, where the short small stamens are separately supported upon numerous distinct processes, attached to a large petaloid organ (androphorum), of which no parallel is to be found in any other natural order.

Another peculiarity of the *Barringtoniaceæ* is, that the *tube* of the *calyx*, agglutinated to an inferior ovary, is expanded above into a free *limb*, which in many cases offers the very singular feature of being vesicoid, quite entire and undivided in the bud, marked by many parallel nerves, all meeting in a mucronate point in the apex; after a while, by uniform internal pressure, caused by the growth of the petals and stamens, this limb becomes ruptured along the nervures, splitting into 2, 3, or 4 subequal segments, which eventually, little changed, are persistent, and crown the summit of the fruit. In other genera of the family the limb of the calyx consists of 4 free, small, rounded sepals, slightly imbricated in æstivation; in a single instance it is cup-shaped, with an almost entire margin.

The *petals*, constantly 4 in number, are generally 3 or 4 times as long as the calycine limb, are oblong, rounded, narrowing towards their base into fleshy claws, which are agglutinated to the monadelphous tube of the stamens so firmly that all fall off together.

The *stamens* in several series are closely united at their base into a monadelphous tube; the *filaments* are slender, somewhat longer than the petals, and are spirally coiled in æstivation, but afterwards they spread into a feathery plume, are mostly furnished, at their curving apex, each with a small 2-celled *anther*; but in some genera those of the outer or of the inner series are bare, the intermediate series alone bearing anthers.

The *style*, which rises from the centre of the ovary, is generally longer than the stamens, is subulate, rather slender, slightly curved, and terminated by a small clavate or lobed *stigma*, and is always persistent on the fruit.

Another feature of importance is the *disk*, which assumes a form so peculiar that it enables us to determine whether any plant presented to our notice belongs to *Barringtoniaceæ* or not—a test of much practical value. As before stated, it is epigynous, flat and annular, and bears upon its outer margin the staminiferous tube, while its inner margin is always more or less expanded into an erect urceolate prominence, sometimes into a tube of some length, which encircles the base of the style, leaving within it a deep hollow over the vertex of the ovary.

The *ovary* also affords good distinctive characters among some of the genera; it is always inferior, and adnate to the tube of the calyx; it is either 2- or 4-celled, with one or two, sometimes more, ovules in each cell. These *ovules* in some cases are erect, but more frequently are suspended from the summit of the cells by distinct funicles; or, when more numerous, they are attached to the axis; in all cases they are anatropous. In their subsequent development generally most of the cells are abortive, leaving only a single fertile cell; and in that only a solitary ovule is matured.

The *fruit* varies in form, is generally of a large size, crowned by the free persistent limb of the calyx; it has a thick pericarp, frequently very thick, sometimes fleshy, but more often of a dry spongy consistence, lined within by an endocarp, forming an osseous or a coriaceous shell, covered by adhering longitudinal woody fibres. This shell is sometimes 4-celled, but more frequently, by abortion, only 1-celled, with a single large seed; in the genera *Careya* and *Planchonia* the seeds are smaller, more numerous, and imbedded in a tough pulp. In the African genus *Petersia*, the *fruit* assumes a very unusual form: the indehiscent pericarp is small, linearly oblong, thin, and scabrous outside, and is cruciformly surrounded by 4 rounded membranaceous wings of much larger dimensions: this, by abortion, is 1-celled, containing a few linear terete seeds, attached to a parietal cord formed by its undeveloped three abortive cells. I did not succeed in determining the form or nature of the embryo, owing to the decay of the seeds. In *Barringtonia* and *Planchonia* the fruits are 4-celled, each cell in the latter producing several seeds, imbedded in a tough pulp. In these genera alone the seeds furnish an embryo with two distinct cotyledons, as will be subsequently shown. With the exception of these two and *Pelersia*, all the other genera (excluding one) uniformly present in each fruit a single large seed with an embryo of peculiar structure, upon the nature of which the opinions of botanists are much divided; and it is necessary to enter into much preliminary detail to ascertain the value of these conflicting views.

This large *embryo*, apparently homogeneous in texture, invariably consists of two main parts, one concentrically encircled by the other at all points, often so intimately agglu-

tinated together that they appear like one homogeneously solid body; but often, in drying, they become visibly distinct, leaving a narrow vacant space between them. This structure was first demonstrated in 1791 by Gaertner[1], who gave several illustrations of it. He regarded the outer body as albumen, and the inner one as a pseudo-monocotyledonous embryo, consisting of 2 fleshy cotyledons and a radicle, all intimately conferruminated into a solid mass.

Blume, in 1826[2], adopted this view; and DeCandolle, in 1828[3], did the same.

Roxburgh, in 1832[4], accorded with the definition of Gaertner, in considering the nucleus to be formed of albumen, of 2 cotyledons and a radicle, all intimately agglutinated into one solid mass; his description, however, is more important, as he figured and described the changes produced in the act of its germination. Within the pericarp he saw the inner body, which he regarded as the embryo, throw out a long shoot at each extremity, to form a new plant, the rootlet issuing from the summit of the fruit, while a young stem, covered with scales, forced its way through the bottom of the pericarp. He added that "this part, which was a prolongation of the plumular extremity, formed the ligneous centre of the shoots, while the external body furnished the cortical part and the leaves: in this growth there was no appearance of any cotyledon; he saw simply the 2 bodies regarded by him as albumen and embryo." He further explained this development by saying that "the albumen performs the same office as a cotyledon," repeating that "by the elongation of its two extremities it furnishes the bark and foliage of the young plant, while the opposite end of the embryo, or central part, supplies the wood and pith, just as in *Garcinia* and *Xanthochymus*; only there the central portion or embryo is very slender, and the permanent root proceeds from the base of the plumule, as in the Monocotyledones, while that from the opposite end of the embryo soon perishes, or remains slender compared with the other."

Wight and Arnott, in 1834[5], defined this embryo as formed of two concentric homogeneous combined layers, not separable into cotyledons and radicle.

Griffith, in 1835[6], described the seed of *Careya*, and its growth in germination. It consisted of an outer fleshy mass enveloping a central body; the outer body is surmounted by a few fleshy scales concealing others; and these form part of the plumule: as the latter expands upwards, it carries with it the scales, which appear alternating on the ascending stem, which, at its summit, throws out true convolute leaves; at first the scaly plumule is concealed by the lobules on the apex of the external body. It is evident, he says, that the inner subulate body is the root, and the minute scales the plumule; so that the outer fleshy mass ought to be considered cotyledonary in its nature, "and might be explained by supposing the cotyledons to be affixed in a peltate manner, and united into a solid mass." This last passage is very obscure, and assumes what is improbable.

Wight in 1840[7] still inclined to his former opinion, and, in order to explain his views, copied from Roxburgh's drawing the figure of a seed of *Butonica* as it appears when germinating within the pericarp.

[1] De Fructibus, &c. ii. 96, tab. 101. [2] Bijdragen, p. 1096. [3] Prodr. iii. 288. [4] Fl. Ind. iii. 634.
[5] Prodr. Fl. Pen. Ind. p. 333. [6] Proc. Linn. Soc. i. p. 280. [7] Icon. tab. 152.

Lindley, in 1845[1], described the fruit of the *Barringtoniaceæ* as fleshy, and containing many bony seeds lodged in pulp, with an embryo in the axis of copious fleshy albumen.

Wight, in 1850[2], expressed his opinion that in *Careya* the embryo of its seed is placed in the axis of a copious fleshy albumen; and he figured it accordingly.

Blume, in 1852[3], repeated his conviction that in *Butonica* the embryo is exalbuminous, with the cotyledons and radicle intimately combined into one homogeneous fleshy mass, ignoring, as he had done before, that it is composed of two distinct concentric bodies, a fact adverse to his conclusion.

Griffith, in 1854[4], described the embryo of *Butonica* as formed of two conferruminated portions. He imagined that "in its central part the upper end represents a radicle, its lower end a plumule; he also supposed all the parts which he figured, between the lowest scales of the superficies and the radicle, to be an adherent cotyledon, or else an immense radicle, and two or several minute cotyledons represented by scales, and an inconspicuous plumula—a peculiar form of embryo analogous to that of *Dracontium* and, in a less degree, that of *Cryptocoryne*." The presence of these scales, however, was observed only in two species; probably in all the others they were absent. Griffith says distinctly they are absent in his *B. conoidea*. He evidently did not think they formed an essential part of the structure; for in the species he describes he noticed much irregularity in the number and situation of the scales.

Miquel, in 1855[5], merely repeated Blume's definition in his monograph of the family.

Dr. Thomson, in 1857[6], gave an able review of the opinions of botanists on this subject, when he came to the conclusion that this form of embryo is exalbuminous, and consists of 2 concentric layers, that the cotyledons are rudimentary, that in germination the central layer is continuous with the pith, and the outer layer continuous with the bark of the new plant, that the plumule (at least almost without scales) is developed into the new stem, while the opposite extremity is elongated into a root. He adds, that in this development the only appearance of foliary growth is in the series of minute scales upon the ascending axis, as shown in Roxburgh's figure; but these are only rudimentary, for the first true leaves are not developed until that axis is 1 or 2 inches long. He had observed numerous instances of this germination, and adds, somewhat ambiguously, that the new stem is a prolongation of a bud springing from the axil of one of the minute scales observed by Griffith. He shows also the close affinity between this form of embryo and that of the Guttiferæ, as Roxburgh had before pointed out.

Here I am able to offer some new evidence bearing upon this subject. In 1854[7], in my paper "On the Structure of the Seed and peculiar Form of the Embryo in *Clusiaceæ*," I showed that it consisted of 2 layers, one placed concentrically round the other; I gave to the outer one the name of *exorhiza*, and to the inner one that of *neorhiza*, because, in germinating, the latter emitted at one extremity a growing stem, at the other a new rootlet; and in confirmation of this view I copied from Roxburgh's drawing a figure of

[1] Veg. King. p. 754.
[2] Illustr. p. 20, tab. 100.
[3] In Van Houtte, Flor. Serr. iv. p. 72.
[4] Notulæ ad Plant. Asiat. iv. pp. 657, 658, pl. 636.
[5] Flor. Ned. Ind. i. 484.
[6] Proc. Linn. Soc. ii. 52, tab. 1.
[7] Linn. Trans. xxi. 243, tab. 26.

the seed of *Xanthochymus* in germination[1]. I had not then witnessed the fact myself; but not long afterwards Dr. Spruce kindly sent me the seeds of a *Clusia* which he gathered in the act of germination and in its several stages of growth. Here the central body I had described became much broader below, and had forced its way through the apical lobes I had figured, rising in a naked subulate form, till it had grown to 10 times the length of the outer body, which had not enlarged in any way, but which, on the contrary, had withered into a mere membrane, after yielding its substance to nourish the growing portion. No scales were visible on the rising shoot; but when it had reached the height above mentioned, it threw out at its summit at first two, and then other decussating pairs of broad rounded leaflets; and at the bottom of the seed a distinct rootlet was evolved. This agrees perfectly with the figure of Roxburgh; only there were no scales, and no appearance of a second root close to the plumule. The specimens of the *Clusia*-seeds are now before me; so that I can vouch for the correctness of this description.

From this we may gather the important fact that the outer body of the embryo forms here no portion of the new plant, and that its use appears only to perform the part of a cotyledon, in affording nourishment to the inner growing portion. It is probable that the same occurs in the germination of the large fleshy embryo in *Butonica*, which Roxburgh figured as growing in the same manner[2]; but we have no evidence to show what becomes of the outer exorhizal portion in those cases, or that it forms any part of the new plant. This would lead to the conclusion that in *Butonica* the exorhiza is simply a cotyledon under a sheathing form, analogous to the radicle of an ordinary dicotyledonous seed from which the cotyledons have have been cut away, leaving a cylinder consisting of an outer sheath confluent round an inner body, terminated by the plumule. An example somewhat similar is figured by Gaertner in *Hippocastanum*[3], with this distinction, that the plumule is there coleorhized, a very rare circumstance in seeds eminently dicotyledonous.

One important point of structure was noticed by Dr. Thomson in the embryo of *Butonica*: in a section of it, under the microscope, he found that both the exorhiza and neorhiza are alike formed of simple cellular tissue and starch granules, but that between them, adhering to both, there exists a distinct layer of delicate vessels, continuous upwards and downwards with the ligneo-vascular cylinder of the stem and root[4]. This, without doubt, is the medullary sheath described by Mirbel[5], investing the cellular tissue of the axis of the plumular support, and forming there all the vessels which constitute the wood and bark in the new plant.

A very instructive example of the kind of embryo in *Butonica* occurs in that of *Caryocar*, which has a gigantic amygdaloid neorhiza, surrounded by a rather thin exorhiza of uniform thickness; the former is of a crescent form, in the upper horn of which is observed the radicular point, and in the lower horn the plumular extremity. The germination commences within the pericarp, as soon as the seed is formed, by the

[1] Linn. Trans. xxi. tab. 26, fig. 34.
[2] Wight, Icon clii. fig. 5, and Roxb. Flor. Ind. ii. 635.
[3] De Fruct. ii. 135, tab. 111. fig. G, H.
[4] Journ. Proc. Linn. Soc. ii. pp. 51, 52.
[5] Elém. i. 114.

plumule perforating the thin coating of the exorhiza, and protruding from it in the form of a collet, bearing 2 very small lobes; this is done while it is confined within its entire integument; but the growth is of short duration, being arrested by the strong resistance of the bony nut, while the inward pressure causes the exorhiza to become moulded into the channel in which the plumule lies. The lobes just mentioned were regarded by Gaertner as cotyledons; and so they have been universally considered; but any one who will reflect for a moment must see that they are, in fact, the plumule; for Gaertner says he could discern no other, and his expression "plumula nulla" is an obvious inconsistency.

We may obtain, by means of analogy, some additional light by comparing the embryo of *Butonica* with that of *Rhizophora*, which germinates also within the pericarp. There the ovary is 3-celled, with several ovules; but the fruit, by abortion, is 1-celled and monospermous; the pericarp is oblong, about 1 inch long, coriaceous, partly inferior, mostly superior, terminated by a bifid style, and surrounded above its base by the persistent calyx; the seed which fills its cavity is invested by a thin integument, has no albumen, and an embryo of singular development, consisting of an external exorhiza and an internal neorhiza. The latter, while upon the tree, begins to swell, and forces its way through the integument and through the pericarp, by rupturing a small hole between the lobes of the style, and it grows to a length of 10 inches by the time that the exorhiza has only extended half an inch beyond the pericarp. This exorhiza is 1 line thick, is of a greenish hue, and is filled with soft threads, probably oil-cells, such as I described in the embryo of *Clusia*, its upper extremity being lacerated by the protrusion of the neorhiza, while at its base, within the calyx, it is terminated by a hollow dome of soft yellow consistence, containing no threads; except in this part, it is confluent with the basal portion of the neorhiza, but is free from it at the dome, which encloses the free plumule that terminates the end of the neorhiza and consists of 4 or 6 small leaflets plicated, convoluted, and converging to a point. This dome-shaped portion is called the *calyptra* by Jacquin, the *albumen* by Gaertner[1]; the exorhiza is the *crus* of Jacquin, the *vitellus* of Gaertner; the neorhiza is the *semen* of Jacquin, the *radicula* of Gaertner; while the terminal free end of the neorhiza is the *conus* of Jacquin, and the *cotyledons* of Gaertner. Jacquin gives a long account of its germination and subsequent growth. The semen (neorhiza) becomes the trunk of the new plant; the tubercles on its surface throw out numerous rootlets that form, ultimately, arched buttresses for its support on the sea-bed beneath it; while, at the other extremity, as soon as it can detach itself from the pericarp, the plumule expands into an ascending stem, crowned by permanent real leaves. In this development the exorhiza seems to perform no other part than to afford its nourishing juices to the young plant; and it gradually withers, as in *Clusia*; the medullary sheath coating the neorhiza quickly generates a system of woody vessels, so hard as to render it difficult to be cut by a knife, the neorhiza being contracted into a narrow central pith,—a structure confirmed by the observations of Griffith; the embryo may be said to be coleorhized by the concealment of the plumule within the terminal dome,

[1] Griffith (Notulæ, iv. 664) calls this *cotyledon*.

which bears much analogy to the nipple-shaped process described by me in *Clusia*, apparently divisible into 2 or 4 lobes, which formerly I regarded as rudimentary cotyledons [1].

The kind of solid embryo found in *Butonica* and many other genera, under different modifications, consists, as before said, of an external exorhiza and an internal neorhiza, the latter having a plumule at one extremity and a radicular nipple at the other, the ends expanding in opposite directions in germination, the one being the precursor of the ascending stem, the other of the descending root; between the two main fleshy bodies, and adhering to both, is the medullary sheath [2], consisting of elementary vascular tissue, which, by the nutriment afforded on either side, yields woody fibres to the root, and gives origin to the wood, bark, and leaves of the new plant, the neorhiza, void of vessels, remaining as the central pith, while the exorhiza, also without vessels, merely gives out all its substance as nutriment to the general growth, and, without expansion, gradually dies away, thus performing simply the function of a cotyledon. To avoid frequent repetitions in the following descriptions, this kind of embryo will be said to be *mesopodal*, because the expansion of its growth in germination is always in the axial portion (neorhiza), while the outer portion (exorhiza) finally becomes atrophied.

The name *tigellum* has been given to the analogous kind of embryo in *Xanthochymus* [3] and other Guttiferæ; but it appears to me a very objectionable term, because the word *tigella*, invented by Mirbel in 1815 [4], and since used by all French botanists, denotes that portion of the plumule, in ordinary cases, which lies between it and the neck of the radicle: this, however, is seldom visible till after the commencement of germination. Jussieu also used it in the same sense [5]; but in a previous page he applies it to the great fleshy mass in the embryo of *Pekea* [6]. Consequently the name *tigellum* ought not to be given to an entire embryo of peculiar form when the same designation has been extensively used by botanists to denote a very small portion, and that often invisible, in the ordinary forms of the embryo in the seeds of both exogenous and endogenous plants.

Such are the leading characters of the *Barringtoniaceæ*, from which it will be seen that they differ widely in their structure from the *Myrtaceæ*, and equally so from the *Lecythidaceæ*. With the former they have hardly a single character in common; for the apparent similarity of their numerous long stamens is destroyed by the insertion of each filament separately upon a *perigynous* disk, while in the *Barringtoniaceæ* they stand in many dense series, all united at their base into a monadelphous tube, inserted on the outer margin of a distinctly *epigynous* disk. From the *Lecythidaceæ* they differ in a totally distinct floral structure.

The *Barringtoniaceæ* appear to me to approach nearer to the *Rhizophoraceæ*; indeed, if we imagine in any plant of the former a flower with the staminiferous tube agglutinated to the limb of the calyx, it would at once be referred to the latter family; it would be especially close to the new genus *Harmena*, established by me upon a plant

[1] Linn. Trans. xxi. 246, tab. 26. figs. 8–10, 26, 27.

[2] Mirbel, Elém. i. 110; Juss. Cours Elém. p. 48, fig. 88, 99.

[3] Ann. Sc. Nat. sér. 4, vol. xiv. tab. 17. fig. 15; Trimen, Journ. Bot. 2nd ser. vol. iv. p. 67, tab. 160.

[4] Elém. pp. 50, 601, pl. 57.

[5] Cours Elém. p. 365. fig. 446, p. 366. fig. 447.

[6] *Loc. cit.* p. 350. fig. 420 (in adnot.).

from Fiji, collected by Dr. Seemann, and which, singularly enough, he referred to *Barringtonia speciosa*[1]. In thus alluding to *Rhizophoraceæ*, I mean the order as established by the late Mr. Robert Brown[2], excluding the *Legnotideæ* and *Cassipoureæ*[3], since united with it[4], but which, it seems to me, ought to be located elsewhere, because they differ widely in the habit of the plants, and in their yielding a resinous juice, in the presence of stipules, in a more panicular inflorescence, in their flowers with laciniated or fimbriated petals, in their semi- or wholly superior ovary, in their fruit containing numerous seeds imbedded in pulp, each seed with a terete dicotyledonous embryo enclosed in copious albumen. There seems, indeed, but little intimate relationship between them, while the true *Rhizophoraceæ* form a well-marked family, the uniformity of which is destroyed by its association with the groups before mentioned.

The *Barringtoniaceæ* have no representative in the American continent, their existence being confined to the Old World, over the tropical portions of which they are widely spread, extending from Africa throughout the Indian and Malay peninsulas, growing in the numerous islands of the Malayan archipelago, in Australasia, in the broadly dispersed islands of the Pacific Ocean, but never reaching the continent of the New World, where the *Lecythidaceæ* exclusively occupy their place.

This is a fact of some value in the question of the geographical distribution of plants, and powerfully tends to support the opinion of those who contend for the separate origin of distinct types.

The genera already described by botanists are *Barringtonia*, *Butonica* (which I have restored), *Stravadium*, *Careya*, *Planchonia*, and *Petersia*, to which are now added *Agasta*, *Doxomma*, *Megadendron*, and *Chydenanthus*, all marked by peculiar characters, as the following clavis will show:—

Generum Distributio.

A. Calycis limbus in alabastro indivisus, maximus, oblongus, demum in lobos 2 ruptus.
- *a.* Embryo dicotyledoneus: semina plurima . . . . . 1. Barringtonia.
- *b.* Embryo mesopodus: semen solitarium . . . . . 2. Agasta.

B. Calycis limbus in alabastro indivisus, mediocris vel subparvus, demum in lobos 3–4 ruptus. Embryo mesopodus: semen solitarium . . . . . 3. Butonica.

C. Calycis limbus in alabastro sectus. Sepala 4 imbricata.
- *c.* Ovarium 2-loculare.
  - * Embryo mesopodus: semen solitarium magnum, pericarpium siccum. . 4. Stravadium.
- *d.* Ovarium 4-loculare.
  - ** Embryo dicotyledoneus: semina plurima in pulpa nidulantia . . . . 5. Planchonia.
  - *** Embryo mesopodus: semina plurima in pulpa nidulantia . . . . . 6. Careya.
  - **** Embryo mesopodus: semen solitarium, magnum; pericarpium siccum . 7. Doxomma.
  - ***** Embryo ignotus: semina plurima, linearia; pericarpium siccum, in alas 4 maximas membranaceas expansum . . . . . 8. Petersia.

D. Calycis limbus sectus: sepala 3–4, valvata. Embryo mesopodus: semen solitarium, magnum; pericarpium siccum . . . . . 9. Megadendron.

E. Calycis limbus integer, cupularis: inflorescentia singulariter paniculata . . . 10. Chydenanthus.

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[1] Flor. Viti. i. p. 82. [2] Gen. Remarks, p. 549. [3] For reasons given by Blume (Mus. Bot. Lugd. i. p. 126).
[4] Endl. Gen. p. 1186; Benth. Hook. Gen. Pl. i. p. 678.

1. Barringtonia.

This genus was established by the two Forsters in 1776, after their return from the second voyage of Capt. Cook, when they published very good analyses of its floral and carpological structure [1], the plant itself being well represented in the drawings of Forster and of others who copied the same. The younger Linnæus, in 1781, gave its generic character [2] and details of the typical plant [3], obtained from a communication made to him from Forster; but as the plant and drawings of it were both unknown to him, he wrongly concluded that it was identical with Osbeck's *Mammea asiatica*, with Sonnerat's *Commersona*, and Rumph's *Butonica*.

Blume in 1827 [4], perhaps wholly unacquainted with the details and drawings of Forster, applied the name of *Barringtonia speciosa*, as the younger Linnæus had done, to other plants found by him in Java; hence in his generic character of *Barringtonia* he ascribed to it carpological features quite at variance with Forster's description and analysis; and to this cause we may attribute all the complications that have since occurred.

DeCandolle, in 1827 [5], not perceiving this mistake, adopted Blume's definition unconditionally—an example followed by Roxburgh, Wight, the Dutch botanists, and authors of every nation since that period; and hence the general confusion at present existing, from which I have here attempted to extricate the family.

One of the most remarkable characters of *Barringtonia* is the presence of a dicotyledonous embryo in the seed, a unique occurrence till lately, when the genus *Planchonia* was established by Blume himself [6] upon some plants from the same region, which present an embryo similar to that of *Barringtonia*. There can now, therefore, be no reason for refusing the acceptance of Forster's characters. As yet we know only the typical species; and it is remarkable that no one except Montrouzier appears to have seen the plant since Forster collected it; the only specimen of it extant, as far as I am aware, is the original type, fortunately preserved in the British Museum. Sir Joseph Banks purchased some duplicates of Forster's plants; but no specimen of the fruit appears in the Banksian collection. It is therefore almost wholly from Forster's materials that the following generic character has been framed, a few further particulars being furnished by Montrouzier.

Barringtonia, Forst. (non alior.).

Calyx in parte adnatus, limbo magno, in alabastro oblongo, integre clauso, parallele nervoso, demum in lobos 2 concavos persistentes rupto. *Petala* 4, magna, oblonga, unguibus ad tubum staminigerum agglutinatis. *Stamina* numerosissima, pluriseriata, in tubum cylindricum subbrevem monadelpha, et cum petala conjunctim caduca: *filamenta* subfiliformia, in æstivatione spiraliter convoluta, demum recta, dilatatim expansa, petalis longiora, colorata; *antheræ* subparvæ, dorso basin versus affixæ, ovato-rotundatæ, flavæ, 2-lobæ, lobis adnatis longitudinaliter dehiscentibus. *Discus* epigynus, horizontaliter annularis, pulvinatus, margine externo tubum staminigerum fulciens, margine interno in eminentiam longiusculam anguste tubularem apice dentatam stylum cingentem expanso. *Stylus* subulato-teres, filamenta paullo excedens, persistens. *Stigma* parvum, capitato-oblongum, cavum.

[1] Char. Gen. p. 75, tab. 38. f. *a*, *b*, *c*.
[2] Linn. fil. Suppl. p. 50.
[3] Ibidem, p. 312.
[4] Bijdr. p. 1096.
[5] Prodr. iii. 288.
[6] In Van Houtte, Fl. Serr. vii. p. 24.

Ovarium inferum, turbinatum, vertice circa stylum angustissime concavo, 4-loculare; ovula in quoque loculo 3, imo radiatim affixa. *Fructus* magnus, obverse pyriformis, apice sensim attenuatus et calyce coronatus, obsolete 4-gonus, indehiscens: *pericarpium* crassissimum, extus læve; *mesocarpium* crassissimum, subcarnosum; *endocarpium* durum, subosseum, extus fibris rugose lignosis laxe intricatis tectum, intus læve, 4-loculare: *semina* in quoque loculo solitaria, subglobosa, rugosa; *embryo* conformis, exalbuminosus; *radicula* ejus longitudine, teres, incurva, apice sursum spectans, truncata, imo brevissime incurvata, et hinc *cotyledones* 2 magnas, erectas, crassifoliaceas, parallele plicatas, æquilongas suffulciens.

Arbor *in insulis Maris Pacifici vigens*; folia *majuscula, cuneato-oblonga, brevissime petiolata, glaberrima*; inflorescentia *terminalis, racemosa*; flores *plurimi, speciosi.*

Barringtonia speciosa, J. R. & G. Forster, Char. Gen. p. 76, tab. 38. f. *a*, *b*, & *c* (1776); G. Forst. Icon. ined. vol. ii. tab. 191 (1776); J. F. Miller, Icon. ined. fasc. ii. tab. 7 (1776); Linn. fil. Suppl. p. 312 (1781); Cook's Voy. vol. i. tab. 24 (1784); G. Forst. Prodr. Fl. Austr. p. 47 (1786); Kerner. Hort. Semp. vol. i. tab. 28 (1796); Guillem. Zeph. Tait. Ann. Sc. Nat. 2e sér. vol. vii. p. 358 (1837), ex MSS. J. G. Forster; Montrouzier in Mém. Acad. Lyon, vol. x. p. 309 (1858): *Butonica*, Lam. (in parte) Dict. i. 521; Illustr.tab. 590 (non 591), ex icon. Mill. iterat. (1783): *Butonica speciosa*, Dryand. in Aiton, Hort. Kew. (in parte) ii. p. 439 (1789): arbor procera, trunco crasso, erecto, ramosissimo, cortice cinereo, fusco, rimuloso; ramulis patentibus, crassiusculis, fistulosis, rugosis, pallide brunneis, sulcato-striatis, apice confertim foliosis, inferne (e foliis lapsis) late cicatricatis: foliis obovatis, apice sensim obtusatis et sæpissime emarginatis (junioribus acutioribus), infra medium subcuneatis et in petiolo lato brevissimo decurrentibus, hinc fere sessilibus, patentibus, quam latitudo duplo longioribus, integerrimis, subcoriaceis, supra profunde viridibus, siccis fuscis, nervis remotis, flavidis, paullo divaricatis et arcuatim nexis, costam versus prominulis, subtus paullo pallidioribus, costa prominente, imo sensim incrassata, et rubicunda: inflorescentia terminali, erecta, thyrsoidea, 3–20-flora; floribus amplis, speciosissimis, alternatim evolutis; rachi crassa, subangulata; pedicellis subsparsis, subpatentibus, longis, validis, apice incrassatis, imo bractea foliosa cuneato-rotunda integra sessili munitis; calycis limbo majusculo, ovato-globoso, apice mucronato, integre clauso, pedicello ter breviore, demum in lobos 2 æquales parallele nervosos concavos patentes rupto; petalis 4, triplo longioribus, obtuse oblongis, expansis, candidissimis, marginibus revolutis, imo roseotinctis, unguibus tubo staminifero agglutinatis; staminibus numerosissimis, imo in tubum monadelphum coalitis; filamentis petalis duplo longioribus, divergentibus, candidissimis, apice roseis; antheris parvis, luteis; disco epigyno, late pulviniformi, margine externo tubum staminigerum fulciente, interno in tubum angustum erectum longiusculum apice denticulatum styli basin vaginantem expanso; stylo subulato, tenui, candido, apice sanguineo, staminibus vix longiore; ovario infero, turbinato, 4-loculari, ovulis in quoque loculo 2–3 ab axi radiantibus: drupa maxima, obpyriformi, calyce coronata, superne conice angustata, inferne rotundata, sub-4-gona; pericarpio lævi, viridi, sicco rufo-fusco, crassissimo, solide carnoso; endocarpio osseo, nuciformi, ovato, extus fibris validis lignosis tecto, intus 4-loculari, loculis sæpius monospermis; seminibus ovato-globosis, rugosis, cerasi magnitudine,

embryone dicotyledoneo generis. In insulis Societatis, Amicorum, et Nova Caledonia: *v. pl. s. in herb. Mus. Brit.* Tahitia, Tonga (*Forster*, pl. typica); *fructus non vidi.*

The above imperfect specimen from the Banksian collection is fortunately preserved in the British Museum.

The leaves in this specimen and in Forster's drawings are 7–10½ in. long, 3¾–5 in. broad, and almost sessile, are crowded at the end of the branches, scarcely 3 lines apart. The terminal raceme is from 6 inches to near a foot long; its thick erect rachis bears from 3 to 20 flowers successively developed, the upper ones (in bud) being only one third of the size of the lower or full-grown ones; the pedicel when full-grown is 5 in. long, 1½ line thick below, increasing to 3 lines in thickness, at the base of which is a foliaceous bract 2 in. long, 1 in broad. The limb of the calyx in the full-grown bud, is quite closed at the summit, is 4 in. long, 9 lines in diameter, and splits open into two large concave expanding lobes, which are marked by strong parallel nerves, and, with the style, are persistent on the fruit; the petals are pure white, 1½ in. long, 1 in. broad, and reflected; the stamens are 3 in. long, united at their base into a tube 4 lines long, 6 lines in diameter; the style is the length of the stamens; the turbinated 4-celled ovary is 6 lines long; the epigynous disk, crenulately pulvinate, is 6 lines in diameter, bearing on its outer margin the staminiferous tube, while its inner margin is prolonged into an erect tube ¾ in. high, narrowing upwards into a pluridentate open mouth, thus concealing the lower part of the style, a section of which is shown in Miller's drawing. The fruit, exclusive of the calycine limb, is 4 in. long and 3¼ broad below the middle. The ovate nut is 4-celled, each cell containing a single seed, which in Forster's drawing is 8 lines long, 6 lines broad, showing a terete radicle of its whole length, turned up at base to support two erect fleshy plicated cotyledons, as I have seen in *Planchonia.*

This plant (which is here shown in Plate X., taken from Forster's drawings) must not be confounded with Solander's species, nor with that of Linnæus, as it has hitherto been. The fruit is called *Futu* by the natives, and, like many others of the same family, is poisonous and used to stupify fish in order to catch them.

Seemann mentions (Pl. Vit. p. 83) the fruit of a similar kind, and probably another species, called in Fiji *Vutu-dina* (genuine Vutu). He did not see it; but it was said to be larger, its exterior portion soft, containing a nut so hard as to require a sharp instrument to open it in order to get to the seeds, which are edible, thus differing from Forster's species. This may probably be the species described by Montrouzier under the name of *Barringtonia speciosa*, which he found in the island Art, near New Caledonia. Although he mentions nothing of the shape of the leaves nor the character of its inflorescence, he gives a full account of its floral structure, which is similar in general details to Forster's plant, but differs in its petals, which are not longer than the calycine lobes; the stamens, too, are shorter; the petals, though white, have a roseate hue, with their margins revolute; the inner margin of the disk seems to differ in being shorter and more urceolate in form, and fimbriate (not dentate) on its margin; the ovary is 4-locular; and he noticed at the base of three of the cells 4 ovules.

To the plate of *Barringtonia speciosa* in Miller's showy book no information is attached,

and it is little more than a copy of Forster's drawing; so also is the plate given in the narrative of Cook's first voyage, and in a wrong place, with an apology from the editor for the omission of any details.

There are some circumstances in the history of this species in relation to the two Forsters that are deserving of notice. John R. Forster, a botanist of some standing, and a friend of Linnæus, was appointed to the 'Resolution' in 1772, on the second voyage of Cook, as botanist to the expedition, with the assistance of his son George, then only seventeen years of age, as draughtsman. After three years' absence they returned to England in 1775. It was previously agreed that the two Forsters should describe the history of the voyage, the profits of which were promised to them. On presenting the first portion, the Lords of the Admiralty would not sanction it unless many obnoxious passages were expunged. This the Forsters refused to do, and withdrew in disgust, the elder to Germany in 1776, where he was appointed Professor of Natural History at Halle, remaining there till he died in 1798. His son George at the same time retired to become Professor at Cassel, and afterwards to Mayence as librarian to the Elector; here entering into the excitement of the French revolution, he went to Paris as deputy to the National Assembly. During his absence the Germans stormed and took Mayence, when all his books and papers were lost, and, bereft of all his property, he left France in despair and went to India, where he died in 1794. Bearing in mind these dates, we find that Linnæus published the diagnosis obtained from the younger Forster a year after his return from his voyage, and in the same year that Forster's 'Char. Gen.' was published. In that work the new genus *Barringtonia* has as its synonym the *Butonica* of Rumph, tab. 114; that was adopted by Linnæus with the addition of another synonym, *Mammea asiatica*, Linn. It is worthy of remark that in that copious diagnosis no notice is taken of the singular nectary, which forms one of the most peculiar features of the genus; on the other hand, in the details of the species, said by Guillemin to be in the handwriting of Forster, this nectary is fully described, and the synonyms above mentioned are also given. The character of the fruit, especially of the seed, as given by the Forsters in their 'Char. Gen.,' is there wholly suppressed, and in its place a description of that of Rumph's *Butonica* is substituted. Another reference is given, to DC. Prodr., published many years after the death of the two Forsters. We may therefore infer that there has been a little tampering with the original MS. in both cases, apparently to suit the views of other persons.

Kerner in 1796 published a beautiful drawing of *Barringtonia speciosa*, copied from that of G. Forster; but he added to it the fruit of Rumph's *Butonica*, tab. 114, instead of the fruit and seed so clearly figured by the two Forsters. This plate is accompanied by a description copied from that of the younger Linnæus.

Van Houtte (Fl. Serr. vol. iv. tab. 409) published coloured drawings purporting to represent *Barringtonia speciosa*; but these were copied from Paxton's without acknowledgment; this I have noticed more particularly under *Agasta asiatica*. Four years later he published (*op. cit.* vol. vii. p. 23) a monograph of the *Barringtoniaceæ*, assumedly from the pen of Blume, where, beginning with *B. speciosa*, he gives to it a whole page of synonyms and references belonging to numerous other species, including

many of *Butonica* and *Stravadium* confounded with it, a list which I feel assured never received the sanction of Blume.

The before-mentioned form only a portion of the many complications in which *Barringtonia speciosa* has been involved by authors; several others are exposed in the sequel.

2. Agasta.

A few of the species referred by authors to *Barringtonia* differ from that genus so essentially, and are so uniform in their structure, that I propose to unite them into a new genus, *Agasta*[1]. I have selected as the type the magnificent species first collected by Dr. Solander in 1769 at Otaheite, when he accompanied Capt. Cook in his first voyage round the world. This plant, scarcely known to botanists, is well represented in Parkinson's inedited beautiful drawings, and is copiously described by Solander in his unpublished notes preserved in the British Museum, where he gives a full account of its floral and carpological characters. The genus agrees with *Barringtonia* in its large thyrse-like raceme of splendid flowers, in its extremely large vesicoid calyx, entire and undivided in the bud, subsequently splitting into two lobes by the pressure of the growing petals and stamens; but it differs from that genus in the development of its large fruit, and the entirely dissimilar structure of its seed. Solander, in his notes, gives an exact detail of this development, showing that the seed is much larger, occupying the entire space of its single fertile cell, being egg-shaped, consisting of an exalbuminous solid embryo, of mesopodal structure, as before described (*ante*, p. 53), and which is found in most of the genera of this family.

Agasta, nob.

Barringtonia auct.; *Butonica*, Soland. (non Rumph.); *Mammea* (in parte), Linn.

Calycis adnati *limbus* maximus, ovato-oblongus, parallele nervosus, in alabastro integer et omnino clausus, demum in lobos 2 concavos ruptus, in fructu persistens. *Petala* 4, lobis calycinis 3–4plo longiora, cuneato-oblonga, unguibus tubo staminigero affixa et cum illo caduca. *Stamina* numerosissima, pluriseriata, imo in tubum brevem monadelpha; *filamenta* filiformia, petalis longiora; *antheræ* parvæ, bilobæ, lobis adnatis, paullo supra basin dorso affixis, rima longitudinali dehiscentibus. *Stylus* filiformis, longitudine staminum, persistens; *stigma* parvum, simplex. *Discus* epigynus, pulvinatim annularis, margine exteriore tubum staminiferum fulciens, interiore in urceolum brevem erectum productus. *Ovarium* inferum, turbinatum, vertice intra discum circa stylum cavato, 4-loculare; *ovula* in quoque loculo 2 vel plura, apice funiculo brevi suspensa. *Fructus* majusculus, conice vel depressius obpyriformis, 4-gonus, lævis, calyce coronatus: *pericarpium* crassissimum, spongioso-carnosum; *endocarpium* coriaceum, extus fibris numerosis lignosis tectum, intus abortu 1-loculare, cum loculis marcidis 3 in chorda longitudinali prominente eo affixa signatum, monospermum: *semen* magnum, loculo conforme; *testa* submembranacea, endocarpio adhæsa; *embryo* exalbuminosus, solidus, eburneus, chordæ impressione longitudinaliter canaliculatus, mesopodus.

Arbores *Asiaticæ, aut in insulis Oceani Pacifici vigentes, altæ, ramosissimæ:* folia *maxima, in apicibus ramorum conferta, oblonga, breviter petiolata, alterna:* thyrsus *terminalis:* flores *speciosissimi, alterni:* pedicelli *longi, apice incrassati, imo* bractea *foliosa decidua muniti:* fructus *viridis, siccus brunnescens, nitidus.*

[1] From ἀγαστὸς, *admirandus.*

1. AGASTA SPLENDIDA, nob.: *Butonica splendida*, Soland. Prim. (ined. 1769), p. 282[1]; in Obs. MSS. Soland. (ined.), p. 382 (excl. synon.); Parkinson, Icon. ined. vol. ii. tab. 68 et 69: *Butonica speciosa*, Dryand. in Aiton, Hort. Kew. 1st edit. (1789), vol. ii. 439 (excl. syn.): arbor elegantissima, ramis late expansis: foliis maximis, sparsis, patentibus, latissime obovatis, supra medium hemisphæricis, basin versus cuneatis, in margine cartilagineo integerrimis, subcoriaceis, planis, in junioribus ovalioribus obtusis et sæpe emarginatis, supra nitidis, intense viridibus, siccis pallidioribus, nervis paucis valde remotis prominentibus, subtus pallidioribus, nervis venisque reticulatis paullo prominentibus, costa imo incrassata, rubicunda; petiolo vix ullo, cum glandula supraaxillari longe supra folii insertionem in ramo distincta: racemo in ramulis novellis terminali; rachi valida, haud longa, compresse angulata; floribus maximis, speciosissimis, sparsis; pedicellis 1-floris, teretibus, crassis, longiusculis, imo foliolis seu bracteis majusculis 2 v. 3 obtuse ovatis concavis æqualibus patentibus persistentibus munitis; limbo calycino in alabastro maximo, ovato, integre clauso, demum in lobos 2 concavos parallele nervosos rupto; petalis 4, magnis, albis, 3plo longioribus, ovato-oblongis, subacutis, expansis: staminibus numerosissimis, pluriseriatis, imo breviter monadelphis, expansis, infra niveis, apice saturate rubris; disco styloque ut in char. gen., intus breviter elevato: ovario infero, turbinato, vix angulato, 4-loculari, vertice intra discum concavo; ovulis plurimis in quoque loculo suspensis: drupa magna, obpyriformi, vix 4-gona, apice sensim constricta et calyce coronata; pericarpio crasso, nitido, viridi-brunnescente; mesocarpio spongiose carnoso; endocarpio coriaceo, fibris lignosis tecto, abortu uniloculari et monospermo, dissepimentis hinc in chordam crassam contractis et ad parietem adpressis; semine magno, oblongo, obtuse 4-gono; testa tenuiter coriacea, molliuscula, albo-incarnata; nucleo albo, sapore astringente, structura forsan aliorum. In insul. Otaheite: *v. pl. s. in hb. Mus. Brit.* Tahiti (*Solander*); *fruct. non vidi.*

This species (here shown in Plate XI., taken from Parkinson's drawing) was collected by Solander during his three months' residence in Otaheite, when he accompanied Capt. Cook on his first voyage to the Pacific in 1769, to observe the transit of Venus; he found it also in the adjacent islands of Huaheine, Ulaietea, and Otaha. He describes it as a magnificent tree, 50 feet high, with a broad expanded head; its copious very large shining leaves, its splendid flowers, measuring 8 in. in diameter, interspersed with large bright pendent fruits, altogether form objects unsurpassed in beauty, and superb ornaments to the forests in the interior of the islands. By the natives it is called *Ahuta* (*Æhutu*). Dryander, from Solander's manuscript, regarded it as belonging to the *Butonica* of Rumph; but subsequently (in 'Hort. Kew.') he considered it identical with the *Barringtonia speciosa* of Forster, collected in Capt. Cook's second voyage, a plant evidently only known to him from Forster's drawings. Solander's plant, though offering a general similarity to the latter, differs from it in its

[1] Primitiæ Floræ insularum Oceani Pacifici, sive Cat. plant. in Otaheite, Eimeo, Otaha, Huaheine et Ulaietea, 1769, diebus 13 Apr. ad 9 Aug. collectarum; Solandri manuscriptæ in Libr. Banks. Musæo Britannico,—a work of great value, never published, and but little known. Parkinson's coloured drawings of the same plants, also unpublished, were made to illustrate that work.

much larger leaves, its flowers of greater size, on a longer raceme and on stouter pedicels, bracteated in the middle, larger calycine lobes, the presence of a large peculiar gland above the insertion of each leaf, and more especially by the different structure of its fruit and seeds. This last consideration places the two plants in distinct genera. Parkinson's exquisite coloured drawing gives an excellent representation of Solander's plant, but shows only the upper leaves, crowded on the summit of the branches as they appeared in nature; but Solander's dried specimens show some of the lower leaves; these are 14–24 in. long, $8\frac{1}{2}$–12 in. broad, quite round at the apex, cuneated below into a broadish obsolete petiole, or expansion of the midrib. Solander states that an inch or less above the insertion of each leaf a reddish obtusely conical gland is observed on the branchlets. The rachis of the terminal raceme is stout; the pedicel of each flower, 6 in. long, $\frac{1}{4}$ in. thick, bears in its middle a leaf-like sessile bract $2\frac{1}{2}$ in. long, 1 in. broad; the adnate portion of the calyx is $\frac{1}{2}$ in. long; the upper portion splits into two large concave lobes, with parallel nervures $1\frac{1}{4}$ in. long, $\frac{1}{2}$ in. broad; the petals are $3\frac{1}{2}$ in. long, $1\frac{1}{8}$ in. broad; the stamens, spreading in all directions, are agglutinated at the base into a monadelphous tube 4 lines long, 8 lin. in diam., seated upon the outer margin of the disk, the slender filaments being 5 in. long; these, with the petals attached, soon fall off together; the subulate persistent style is longer than them. The fruit is 4 in. long, $2\frac{3}{4}$ in. broad below the middle, is crowned by the persistent calyx, disk, and style. The thick pericarp encloses a single seed, covered by a thin soft coriaceous testa, the nucleus, homogeneous in texture, being white, oval, obsoletely 4-angled, the size of a pheasant's egg; this is not edible, owing to its astringent flavour. In a note by the editor of 'Cook's Voyages' (p. 157), it is stated that the plant is used by the natives of Otaheite to catch fish by intoxicating them.

2. Agasta asiatica, nob.: *Mammea Asiatica*, Linn. Sp. Pl. i. p. 501 (1753); Osb. Itin. (1752), Voy. China, Engl. edit. 2, p. 62 (1771): *Stravadium macrophyllum*, Bl. in Van Houtte, Fl. Serr. vii. p. 24: *Barringtonia macrophylla*, Miq. Flor. Ind. Ned. i. p. 491: *Barringtonia speciosa*, Linn. fil. Suppl. p. 312 (1781); Gaud. in Freyc. Voy. p. 482 (non Forster); Guillemin (in parte), in "Zephyritis Taitensis," Ann. Sc. Nat. 2nd ser. vol. vii. p. 358 (1837); Paxton (non Forst.), Mag. Bot. x. p. 241 (cum icon. color.); Blume (non Forst.) in Van Houtte, Flor. Serr. vol. iv. p. 409, cum icon. color. (ex icon. Paxt. clept.); Benth. (non Forst.), Lond. Journ. Bot. ii. 221; Flor. Austr. iii. p. 221; Seem. (non Forst.), Flor. Viti. i. p. 82; Lindl. Veg. Kingd. (ex Paxton), p. 755, fig. 503 *: arbor grandis, late frondosa, ramulis pendulis, crassis, striatis, rufo-brunneis, pruinosis, fistulosis: foliis maximis, congestis, elongato-oblongis, apice late ovatis, rotundatis vel obtusioribus, infra medium sensim angustatis, acutis, vel sæpius circa petiolum rotundato-truncatis, integerrimis vel subrepandis, chartaceis aut subcoriaceis, supra nitidis, pallide viridibus, nervis divaricatis arcuatim nexis, venis transversis reticulatis, costa plana, imo sensim incrassata, subtus pallidioribus, flavescenti-brunnescentibus, opacis, costa nervisque rubidulis, prominentibus; petiolo brevissimo, lato, supra plano, limbo

60plo breviore: racemo terminali, spicatim plurifloro, rachi crassa suberecta; floribus alternis, speciosis; pedicellis validis, longiusculis, apice crassioribus; calycis limbo maximo, primum oblonge globoso, integre clauso, parallele nervoso, demum in lobos 2 oblongos concavos fuscos minute granulosos rupto; petalis 4, duplo longioribus, obtuse oblongis, albis; staminibus sanguineis, disco styloque ut in char. gen.; ovario infero, turbinato, late 4-gono, 4-loculari ovulis in quoque loculo 5–6, suspensis: fructu majusculo, pyramidato, acute 4-gono, calyce coronato, imo umbilicato et cordatim truncato, abortu 1-loculari et monospermo; pericarpio crassissimo, spongioso; endocarpio extus fibris lignosis crassiusculis intricatis tecto; embryone mesopodo. In Malacca, Java, Australia, insulis Maris Pacifici et Mauritianis: *v. s. in herb. Mus. Brit.* Java (*Horsfield*), in ins. St. Helena cult. (*Home*); *in hb. Hook.* Sincapoor (*Anderson*), Australia (*Hill*), Fiji (*Barclay* 3427), Fiji (*Seemann* 148), in ins. Maurit. (*Blackburn*), in ins. Mohelle (*Meller*); *in herb. Soc. Linn.* Penang (*Wall. Cat.* 3632 A), Sincapore (*Wall. Cat.* 3632 B), Cambodia (*Wall. Cat.* 3632 D): *v. fruct. in Mus. Brit. et Kew.*

Linnæus never saw this splendid plant, but described it in 1753 from the excellent materials furnished by Osbeck, who first observed it in 1752 upon an island near Java. Osbeck says it is a good-sized tree, often procumbent, with wide-spreading branches, hanging over the maritime shores or in the estuaries of rivers. He relates that he had much difficulty in collecting a specimen, owing to the furious attack of ants, which in myriads live in its fistulose branches. The younger Linnæus, in 1781, five years after the date of Forster's 'Genera,' and after his retirement to Germany, published a full description, purporting to be that of the *Barringtonia speciosa*, Forst., as obtained from Forster, and giving as its synonyms very different plants, the *Mammea asiatica* of Osbeck, the *Commersona* of Sonnerat, and the *Butonica* of Rumphius (tab. 114). Copying Rumphius, he states it to be a lofty tree, at the same time that he took the description of the leaves and inflorescence from Osbeck's details. A singular coincidence here occurs: his long diagnosis is in many parts a copy, word for word, of Forster's MSS description of his *Barringtonia speciosa* existing in the Paris Museum, according to Guillemin; but the diagnosis of Linnæus omits all mention of the peculiar nectary and the unusual features given by Forster of the fruit and seeds—characters that serve above all others to distinguish the two species as belonging to distinct genera. As it now stands, Linnæus's diagnosis may be taken as a fair account of *Agasta asiatica*; but as a description of *Barringtonia speciosa* it must be absolutely rejected.

Osbeck states that its leaves are obovate, and more than 1 foot long; Horsfield's specimens agree in form, are 15 in. long, 7 in. broad, on a petiole 3 lines long, 2 lines broad. The specimens from Penang, Singapore, Cambodia, and other places above quoted, all accord in nearly similar dimensions and in the same length of petiole; but Blume states that in his plant the leaves are 10–20 in. long, 5–8¼ in. broad, on petioles 5–6½ lines long—probably a mistake.

We have, however, an admirable account of this plant, introduced into Salisbury in a living state under the name of *Barringtonia speciosa*. The main leaves grew to a length of more than a foot; but the upper leaves became gradually smaller. The plant flourished

thirteen years, growing to the height of 8 feet; and it became necessary to cut off its top for the length of a foot, which cutting, when planted in a pot, grew rapidly, and produced a terminal thyrsoid inflorescence 22 inches long, from which the drawing of one of the flowers of the natural size, together with its floral leaf, was published by Paxton in 1843. This terminal inflorescence was 18–24 in. long, with axils about 1 in. apart. The floral leaf is figured as 9 in. long, 3 in. broad, almost sessile; in the axil of each leaf a single large pedicellated flower originates. The lower pedicels of the full-grown flower are 2 in. long; these gradually diminish in size to $\frac{3}{4}$ in., supporting the young buds: the pedicels are stout and erect, each bearing on its summit the inferior ovary, crowned by the limb of the calyx, divided into two concave lobes nearly $1\frac{1}{2}$ in. long. It has 4 white petals, 2–$2\frac{3}{4}$ in. long, $1\frac{1}{4}$–$1\frac{1}{2}$ in. broad, attached by their claws to the staminiferous tube; the filaments, of a sanguineous purple, are 3–$4\frac{1}{2}$ in. long; the style is 4–5 in. long. Only one flower blossomed at one time, which fell off next morning, when it was followed by others in succession. This account was published in 'Paxton's Magazine.'

Van Houtte in 1848 copied the two drawings of Paxton in his 'Flore des Serres' without acknowledgment, leading us to suppose they were made from a plant cultivated in Belgium. He omitted all the interesting observations of Paxton, but gave a description of it, copied word for word from Rumphius's account of his *Butonica*, also without the least mention of the source from which it was taken.

This plant was introduced into the island of St. Helena prior to 1780, where it flourished in the garden of the Governor, and probably still exists there, as we know it was living a few years ago.

The fruits in our museums are without localities; but those of this species are recognizable from those of *A. indica* by their larger size, their more regular pyramidal quadrate form with rounded angles, and more truncated (not cordate) base. The largest specimens I have seen are $4\frac{1}{2}$ in. long, $3\frac{1}{2}$ in. broad at the sides; others are $3\frac{1}{2}$ in. long: the pericarp is polished, and of a pale colour, is very thick and spongy; the endocarp is coriaceous, and is covered outside by ligneous fibres, which extend from the style to the top of the pedicel; a large exalbuminous embryo fills the cell, is $2\frac{3}{4}$ in. long, $1\frac{1}{2}$ in. broad, and in a transverse section shows a vacant space between the exorhiza and neorhiza.

Seemann states that these large fruits are used by the natives of Fiji in their games, and that they serve as floats for their fishing-nets. As in the preceding species, they are poisonous, and are used to catch fish by stupifying them. In Fiji these fruits are called *Vutu*, in the Tonga islands *Futu*, in the Pacific islands *Hutu*, *Hootu*, in Amboyna and Java *Huttum*. Seemann adds that this species in Fiji is a magnificent sea-side tree, and that it furnishes the material *liku*, of which the women's dresses are made.

The analysis of the flower and fruit of this species is shown in Plate XII.

3. Agasta indica, nob.: *Barringtonia speciosa*, W. & A. (non Forst. nec Roxb.), Prodr. Fl. Penins. p. 333 (excl. syn.); Wight, Icon. tab. 547 (excl. fig. fruct.); Thwaites, Enum. p. 119; *sine nomine* in Hermann, Icon. ined. tab. 241: arbor, ramulis crassis, cicatricatis, 4-angulatis, pallide brunneis, fistulosis; foliis oblongis, apice gradatim obtusis, infra medium angustioribus, imo anguste rotundato-truncatis, marginibus cartilagineis integris, chartaceis, supra lucentibus vel sub-

opacis, pallide viridibus, nervis patentim divaricatis, costa plana imo sensim incrassata, subtus pallidioribus, opacis, nervis costaque prominentibus; petiolo brevissimo, late sulcato: racemo terminali, thyrsoideo, erecto, folio breviore; floribus majusculis, speciosis; pedicellis longis, teretibus, divaricato-erectis, imo bractea foliosa acute oblonga caduca munitis; calycis limbo magno, primum oblongo et integre clauso, parallele nervoso, demum in lobos 2 concavos rupto; petalis 4, duplo longioribus, acute oblongis, concavis, suberectis; staminibus numerosissimis, ista excedentibus ; disco intus urceolatim expanso styloque ut in char. gen.; ovario infero, turbinato, sub-4-gono, 4-loculari, ovulis in quoque loculo 6, axi superne affixis: fructu majusculo, calyce coronato, subglobose 5-angulato, apice subito attenuato, angulis acutissimis in lobis basalibus continuis, imo plus minusve profunde cordatis et umbilicatis; cæteris ut in specie precedente. In India orientali et Ceylonia indigena; in insulis Comorinis et in Mauritio forsan introducta: *v. s. in hb. Soc. Linn.* Madras (*Wall. Cat.* 3632 c); *v. fructus in Mus. Kew.* Comorin (*Kirk*).

A tree of moderate size, with wide-spreading branches, at the extremities of which the leaves are approximated at a distance of 3 lines; the leaves vary in size from $4\frac{1}{2}$–12 in. long, $2\frac{1}{4}$–7 in. broad, on petioles 1–2 lines long and broad: the rachis of the raceme is $3\frac{1}{2}$ in. long; the lower pedicels $2\frac{1}{2}$ in. long. the upper ones in bud gradually much shorter, the basal bract in the former $1\frac{1}{4}$ in. long, 5 lines broad; the calycine lobes are 1 in. long; the petals $1\frac{3}{4}$ in. long, 1 in. broad, falling off attached to the staminiferous tube; the filaments are 2 in. long; ovary 5 lines long. The fruit figured by Wight does not belong to it; he confesses that he never saw it, but copied it from Gaertner's tab. 101, which belongs to a very different plant—*Butonica Rumphiana*, from the Dutch Asiatic settlements, and the fruit of which accords with Sonnerat's drawing of it. The fruit of the Indian species may be recognized by comparison with Hermann's drawing of it; the largest specimens in the British Museum (locality not cited) are $4\frac{1}{4}$ in. long, $4\frac{1}{2}$ on the sides, $5\frac{3}{4}$ in. across the angles, the cordate basal lobes extending $\frac{1}{2}$ in. below the attachment upon the pedicel. Kirk's specimen from Mohille is similar in shape, but only half that size; that in Hermann's drawing is intermediate in size, and similar to others in the British-Museum collection.

This handsome well-marked species is distinguished from the two preceding by its more oblong leaves, shorter racemes, with smaller flowers, shorter petals, and by the shape of its fruit. The upper leaves in Wight's plate 547 agree in size and shape with those in Hermann's drawing; but the lower leaves are gradually much larger.

The specimen of the fruit found by Dr. Kirk on one of the Comorin Islands was probably floated by sea from the Indian coast, as Commerson and Sonnerat relate, and is known by the name of "*Bonnet rouge.*"

The floral and carpological features are shown in Plate XII.

3. Butonica.

This genus was first described in 1744 by Rumphius[1], was acknowledged by Lamarck in 1783[2], and by Jussieu in 1789[3]; but the younger Linnæus, in 1781, united it with the

[1] Amboyn. v. p. 179. [2] Dict. Méthod. i. 521. [3] Gen. Pl. p. 326.

Barringtonia of Forster[1]. . His example was followed by DeCandolle in 1728[2], and by all succeeding botanists, which has greatly contributed to the confusion at present existing. The genus differs from *Agasta* very conspicuously: its leaves are more chartaceous, and serrated on the margins (not coriaceous and entire); its inflorescence is an elongated pendulous many-flowered spicated raceme (not erect and thyrsoid with few, very large flowers); the flowers are smaller, on much shorter slender pedicels, with a calyx always conspicuously smaller, globose, and splitting into 3, rarely 4 lobes (not long, oval-oblong, and rupturing into two large concave lobes). It consists of several arborescent species, growing inland in moist places, or in estuaries on the sea-shores. The leaves are generally large, more or less acute and cuneated, and the racemes very long, with handsome flowers. The fruit, in structure, resembles that of *Agasta*, and, owing to its thick spongy pericarp, is often found floating at sea along the Malayan coasts; they are also often found upon the coasts with the seeds germinating within the pericarp, after the manner shown by Roxburgh[3].

Butonica, Rumph., Lam. et Juss.

Barringtonia, Linn. fil. (in parte) et alior.; *Stravadium* (in parte), DC.; *Commersona* et *Menichea*, Sonnerat.

Calycis adnati *limbus* mediocris, in alabastro globosus, integre clausus, mucronulatus, parallele nervosus, demum in lobos 3 vel 4 ruptus, viridis, persistens. *Petala* 4, triplo longiora, oblonga, unguibus tubo staminigero adglutinata et cum illo caduca. *Stamina* numerosissima, pluriseriata, imo breviter monadelpha, iis *Barringtoniæ* similia. *Discus* epigynus, plane aut pulvinatim annularis, margine exteriore tubum staminigerum fulciens, interiore in osculum elevatum expansus. *Stylus* et *stigma* ut in *Agasta*. *Ovarium* inferum, turbinatum, 4-loculare; *ovula* in quoque loculo 2 vel plura, ab axi vel summo suspensa, anatropa. *Fructus* majusculus, cylindricus, ovatus, pyramidatus aut obpyriformis, obsolete vel acute 4-gonus, aut 6-sulcatus cum alis 6 crassis pendentibus, apice subattenuatus et calyce coronatus, indehiscens: *pericarpium* nitidum, crassissimum, spongioso-carnosum; *endocarpium* tenuiter coriaceum, extus fibris numerosis lignosis tectum, intus abortu 1-loculare, cum loculis marcidis 3, in *chorda* longitudinali prominente eo affixa signatum, monospermum: *semen* magnum, loculo conforme; *testa* submembranacea, endocarpio adhæsa; *embryo* exalbuminosus, solidus, amygdalinus, sæpe edulis, ovatus, chordæ impressione longitudinaliter canaliculatus, interdum striolatus, mesopodus.

Arbores *Asiaticæ, et in insulis maris Pacifici indigenæ, ramosissimæ, ramulis sæpe fistulosis:* folia *plerumque majuscula, oblonga, sæpius utrinque acuta, plus minusve serrata, brevissime petiolata:* racemi *terminales, longi, spicati;* flores *speciosi, breviuscule pedicellati:* fructus *majusculus, forma varia, nitidus, lævis, sæpius ruber.*

1. Butonica alba, Rumph. Amb. v. cap. 30, p. 181, tab. 116 (ubi planta valde diminuta): *Stravadia alba*, Pers. Ench. i. p. 30: *Stravadium album*, DC. Prodr. iii. p. 289: *Barringtonia alba*, Bl. in V. Houtte, Fl. Serr. vii. 24; Miq. Fl. Ind. Ned. i. 485; Hask. Bot. Zeit. xxvii. p. 598: *Barringtonia conoidea*, Griffith, Notulæ, p. 656; Icon. Pl. Asiat. tab. 635. fig. 1 ad 18 (plant. et flor. analysis) et tab. 634 (in parte quoad semen?): arbuscula, ramulis crassiusculis, rugosis, subsulcatis, fistulosis,

[1] Linn. fil. Suppl. Sp. pl. p. 312. [2] Prodr. iii. p. 288. [3] Wight, Icon. i. tab. 152.

e foliorum lapsu cicatricatis: foliis majusculis, elongato-oblongis, apice sensim aut repentius acuminatis, infra medium subcuneatis, imo acutis vel circa petiolum anguste rotundato-truncatis, marginibus cartilagineis undulato-revolutis, crenato-serratis, chartaceis, supra viridibus, opacis, sub lente impresso-rugulosis, nervis tenuibus arcuatim nexis prominulis, reticulatis, subtus pallide brunnescentibus, minutissime granulatis, costa striolata imo sensim crassiore, nervisque pallidissimis prominulis; petiolo crasso, semitereti, limbo 12–20plo breviore: racemis elongatis, pendulis, minute velutinis, floribus speciosis subsparsis, pedicellis imo articulatis et 2-bracteolatis; calycis limbo subparvo, globoso, demum in lobos 3–4 rupto; petalis 4, fere triplo longioribus, oblongis, lateribus retroflexis, carnosulis, albis; staminibus, disco styloque ut in char. gen.; ovario infero, subcylindrico, 8-sulcato, 4-loculari, ovulis in quoque loculo 2 apice suspensis: fructu ovali, utrinque rotundato, obsolete 4-gono, calyce coronato, abortu 1-loculari et monospermo; pericarpio viridi, crassissimo; endocarpio coriaceo, extus fibris lignosis tecto; testa tenui, cum raphe ramosa parallele nervosa; embryone mesopodo, solide eburneo, 4–8-sulcato. In Malacca et ins. Archipel. Asiat. in fluviatilibus: *v. s. in hb. Hook.* Mergui (*Griffith*), Malacca (*Maingay* 760); *in hb. Soc. Linn.* Sincapore (*Wall. Cat.* 3632 B), Penang (*Wall. Cat.* 3634 B et 3634 D), in hort. Sundriban cult. (*Wall. Cat.* 3634 A).

The above specimens agree well with the description by Rumphius of his *Butonica alba*, the drawing of which in his plate 116 is on a scale so reduced as to give little idea of its character, all the parts being diminished to one fifth of their natural size. Griffith's plant quite accords with the description; but in his plate the leaves and flowers are reduced to half their natural size; his manuscript details are very good and ample, and the analysis of the flower in its natural size is quite complete; his figs. 13–17 show sections of the ovary, much magnified. Rumphius says its leaves are 18 in. long, 5–6 in. broad, with obsoletely crenulate margins, pallidly fuscous below, with raised white nerves; racemes 2–3 feet long; calyx divided into lobes; white petals, white stamens, reddish at base; fruit pome-shaped, 3 in. long, 2 in. broad, deep green colour, marked by areolar impressions; nucleus white, not edible. The above diagnosis is framed upon Griffith's specimen and drawing; here the leaves are $10\frac{1}{2}$–$12\frac{1}{2}$ in. long, 4–5 in. broad, on thick petioles 3–4 lines long (shown half size in his drawing); raceme 1–2 feet long, slender pedicels 4–6 lines long; bracts nearly 1 in. long, very caducous; calyx globular in the bud, and 4 lines in diam., splitting at first into 2, then into 4 lobes; petals 10 lines long, 5 lines broad; the oval fruit is 3 in. long, 2 in. broad, with a pericarp 2–3 lines thick; seed oblong, tapering to its suspended summit, 15 lines long, 10 lines broad. This seed appears represented in some of the figures of Griffith's plate 634, there being no room for it in his plate 635 (see under *Careya sphærica*). In the memorandum attached to his specimen, he says the solitary seed is suspended, with a very thick coriaceous integument, is sulcate outside; its embryo is homogeneous, agreeing with the figures above mentioned. Its analysis is shown in Plate XIII.

2. Butonica racemosa, Juss. Gen. 326 (excl. syn.): *Eugenia racemosa*, Linn. Sp. Pl. 673; Fl. Zeyl. 191 (excl. syn.); Lam. Dict. iii. 197 (excl. syn.): *Jambos sylvestris Saam-*

stravadi, Rheede, Hort. Mal. iv. p. 11, tab. 6; Willd. Sp. Pl. ii. 966 (excl. syn.); *sine nomine*, Hermann, icon. ined. tab. 212, 213 & 239: *Barringtonia racemosa*, Bl. (non Gaud.) in DC. Prodr. iii. 288 (excl. syn.); Roxb. Fl. Ind. iii. 634 (exclus. syn. in parte); W. & A. Prodr. Fl. Ind. i. 133 (excl. syn.); Wight, Illustr. p. 19; Wight, Icon. tab. 152 (excl. fruct. fig.); Hook. Bot. Mag. tab. 3831; Wall. Cat. 3684 D; Thwaites, Enum. Pl. Zeyl. (excl. var. β), p. 119: arbor alta, ramosa, trunco recto; ramis crassis, cylindricis, e foliorum lapsu crebre cicatricatis; ramulis tenuibus pendentibus: foliis lanceolato-oblongis, infra medium ad basin gradatim angustatis, apice sensim longe acuminatis, marginibus subrevolutis, crenulato-serratis, tenuiter chartaceis, supra viridibus, nervis subpatentibus arcuatim nexis prominulis, venis transversim reticulatis, costa plana, imo latiore, subtus flavide opacis, nervis prominentibus; petiolo latiusculo, supra sulcato, late marginato, rubro, limbo 60plo breviore: racemo terminali, pendulo, glaberrimo, rachi valida, longa, spicatim multiflora; floribus speciosis, breviter pedicellatis; pedicellis imo bractea minuta caduca munitis; calyce globoso, demum in lobos 3–4 rupto; petalis acute obovatis triplo longioribus, marginibus retroflexis, flavidis; staminibus rubris, disco, styloque ut in char. gen.; ovario infero, turbinato, acute 4-gono, 2–3-loculari, ovulis plurimis in quoque loculo, ab axi radiantibus: drupa majuscula, obverse obovata, apice sensim coarctata, ubi 4-sulcata et calyce coronata; pericarpio crassissimo, extus viridi; mesocarpio albido, demum brunnescente, spongioso; endocarpio fibris lignosis tecto, abortu 1-loculari et monospermo; semine magno, oblongo, utrinque acuto, appenso, homogeneo, ab utraque extremitate germinante. In Indiæ peninsula: *v. pl. s. in hb. Soc. Linn.* Sundriban (*Wall. Cat.* 3634 A); *hb. Finlayson* (*Wall. Cat.* 3634 D).

This is described by Rheede as a tree of vast size, growing in moist woods, and by Roxburgh as a lofty tree, with a head of many spreading branches; its trunk gives a dense wood of a yellowish white colour; its leaves are 3–15 in. long, $1\frac{1}{2}$–4 in. broad, on a broad petiole 3–4 lines long. The rachis of the raceme is 2 feet long, and expands to a width of $1\frac{1}{2}$–2 in., with flowers $\frac{1}{2}$–$\frac{3}{4}$ in. apart, on pedicels 3–6 lines long; calycine lobes after expansion 4 lines long; petals 9 lines long, 4 lines broad, white; filaments $1\frac{1}{4}$ in. long, white, agglutinated at base into a tube 3 lines long. The drawing of Hermann agrees with that of Rheede as to the size and shape of the fruit, which is 3 in. long, $2\frac{1}{4}$ in. broad; that in Roxburgh's figure is similar in shape, $2\frac{3}{4}$ in. long, 2 in. broad below the middle, and shows the seed germinating within the pericarp, throwing out a young stem from the extremity near the pedicel, and a rootlet from the apex of the fruit—a development analogous to that described by Rumphius in *Butonica Rumphiana*; it shows that the seed must be suspended, and that the plumular extremity of the neorhiza points to the base of the fruit. A very good representation of the plant is given by Sir William Hooker, drawn from a specimen cultivated in Liverpool, and received from Bombay. In three years' time, when 8 feet high, it yielded flowers in a raceme 28 in. long.

Linnæus first described the species in his Ceylon Flora, on a plant not seen by him, upon the drawings of Hermann's Ceylon plants, and again in his Sp. Plant. no. 5, where he considered it to be identical with Rheede's Malabar Saamstravadi, tab. 7.

3. Butonica Rumphiana, nob.: *Butonica*, Rumph. Amb. v. cap. 29, p. 179, tab. 114 Lam. Encyl. i. 521 (excl. synon.): *Barringtonia speciosa*, Gaertn. (non Forst.), De Fruct. ii. p. 96, tab. 101 (excl. synon.); Roxb. Fl. Ind. iii. 636; Bl. (in parte), Van Houtte, Fl. Serr. vii. p. 23: *Barringtonia racemosa* auct. (in parte): *Commersona*, Sonnerat, Voy. Guin. p. 14, tab. 8 et 9: *Mitraria Commersoni*, Gmelin, Syst. p. 799: *Fructus peregrinus tetragonus*, Clus. Exot. lib. 2. cap. 5: *Stravadium rubrum*, DC. (in parte), Prodr. iii. 289: arbor, ramulis cinereis, apice crebre foliosis; foliis majusculis, elongato-oblongis, apice sensim angustioribus et breviter acuminatis, infra medium gradatim angustioribus, et imo rotundiuscule truncatis, margine serrulatis, supra profunde viridibus, nervis tenuibus costaque subimmersis, subtus pallidioribus, costa nervisque valde prominentibus; petiolo semitereti, limbo 70plo breviore: racemo elongato, pendulo, pruinoso; floribus speciosis, sparsis; pedicellis subbrevibus, bractea foliosa valde caduca munitis; calyce mediocri, globoso, demum in lobos 2, dein in 4 rupto; petalis 4, duplo longioribus, oblongis, concavis, albis; staminibus, disco styloque ut in char. gen.; ovario turbinato, 4-loculari, ovulis in quoque loculo 2 appensis: drupa mitræformi, infra medium obtuse 4-angulata, superne sensim angustata, imo truncata et umbilicata, extus rubra, aut sicca flavescente, nitida, lobis calycinis immutatis coronata. In insulis Archip. Asiat. et in Siam: *v. s. pl. in hb. Hook.* Siam (*Schomburgk*); *v. fr. s. in Mus. Brit.*

This is described by Rumphius as a lofty tree growing near the sea-shore, throwing out many spreading branches after the manner of *Terminalia Catappa*, with leaves 16–18 in. long, $4\frac{1}{2}$–6 in. broad, on a petiole $1\frac{1}{2}$ line long and half that breadth, all much reduced in his drawing.

In Sonnerat's drawing the flowers expanded, 2 inches in diameter, are 3 lines apart, on a stout rachis 3 in. long, with bracts $1\frac{1}{2}$ in. long, 1 in. broad; pedicels 3 lines long; lengthening with the growth of the fruits, when they bend backwards; calyx in bud globose, 6 lines in diameter, splitting into four persistent lobes; petals 8 lines long; stamens 1 inch long.

The drawing of Rumphius agrees with that of Sonnerat as to the size and shape of the fruit, and is identical with that of the *Barringtonia speciosa* of Gaertner (non Forst.) in his plate 101; it is $2\frac{1}{4}$ in. long, $2\frac{1}{2}$ in. broad, with quadrate sides, 4 obtuse angles, gradually contracting into a narrow neck at the summit, where it is crowned by the persistent calyx. Rumphius describes the seed as germinating within the fruit as it lies on the sea-shore, when a new shoot or stemlet first protrudes from the end, close to the pedicel, while a new rootlet is emitted from the apex, just as Roxburgh figures it in *B. racemosa*. He also mentions a kindred species from Celebes, where the fruit is the size of a child's head. Sonnerat, who gives a good account of this plant, which he found at Pulo Penang, says that its fruit is frequently found at sea, floating between the islands.

Schomburgk's specimens are referred to this species, because they agree in the size and shape of its leaves, which are 7–$10\frac{1}{2}$ in. long, 3–$4\frac{1}{4}$ in. broad, on a petiole 1–$1\frac{1}{2}$ line long; the raceme is about 9 in. long, with flowers about $\frac{1}{2}$ in. apart; the globular calyx in bud is 5 lines in diam., splits first into two, then into 4 lobes; the petals are 9 lines long, the ovary 4-celled. For the structural characters of this species see Plate XIII.

4. Butonica terrestris, Rumph. Amb. iii. lib. 5. cap. 30. p. 181, tab. 115 (pl. ad $\frac{1}{4}$ dimens. reduct.): *Barringtonia elongata*, Korth. in Kruidk. Arch. i. p. 206 (nomen solum): *Barringtonia racemosa*, Bl. (non Juss.), in Van Houtte's Flora, vii. p. 23; Miq. Fl. Ned. Ind. i. p. 486: *Barringtonia rubra*, Miq. *l. c.* p. 487: *Stravadium rubrum*, DC. Prodr. iii. 289 (excl. syn.): arbor demissa, ramulis crassiusculis, fistulosis, rufo-brunneis, pruinosis: foliis approximatis, majusculis, elongato-oblongis, apice acute attenuatis, imo spathulato-cuneatis, angustatis, et in petiolo decurrentibus, marginibus subrepandis et supra medium sinuato-serratis, dentibus obtusulis sæpe aciculato-mucronatis, tenuiter chartaceis, supra pallide viridibus, opacis, nervis adscendentibus utrinque circa 20 tenuibus prominulis et marginem versus arcuatim nexis, subtus flavide pallidioribus, opacis, nervis costaque lata striolata prominentibus; petiolo subtenui, limbo 16plo breviore: racemo terminali, pendulo, folio vix longiore; rachi subtenui, striata; floribus alternis, subremotis, breviter pedicellatis; calycis limbo mediocri, globoso, demum in lobos 3 ovatos concavos rupto; petalis 4, duplo longioribus, obovatis, rubris; staminibus, disco styloque ut in char. gen.; ovario turbinato, sub-4-gono, 4-loculari, ovulis in quoque loculo 2 suspensis: fructu oblongo, utrinque obtuso, calyce coronato, costato-4-gono, rugoso, viridi, demum flavide brunneo, abortu 1-loculari et monospermo; seminis embryone mesopodo, rotunde oblongo, obsolete 4-gono. In Java orientali indigena et in hort. Bogor. cult.: *v. s. in hb. Hook.* Banca (*Horsfield*), Patjetan (*Horsfield* 209).

The specimens above quoted accord well with Rumphius's *Butonica terrestris rubra* in the size and shape of the leaves as well as in the inflorescence, agreeing with the dimensions given in the text; but on his plate 115 the plant is reduced to a quarter of its proper size, which makes it difficult of recognition; we cannot hesitate, however, in considering them specifically identical. Rumphius describes it as a low tree, growing in gravelly soils, in woods remote from the sea. According to his account, the leaves are narrower and more flaccid than in the other plants described by him; they are acute at both extremities, obsoletely serrulate, 12–18 in. long, 3 in. broad, and petiolated; the raceme is 2 feet long, with somewhat remote flowers; the calyx is divided into 2 or 3 lobes; petals and stamens red; the fruit, crowned by the calyx, is 3 in. long, $1\frac{1}{2}$ in. broad. In Horsfield's specimens the leaves are $11\frac{1}{2}$ in. long, $2\frac{3}{4}$ in. broad, on petioles 8 lines long; the raceme is above a foot long, with flowers $\frac{3}{4}$ in. apart, on pedicels 1 line long; the calycine lobes are 4 lines long; the petals 8 lines long, 6 lines broad, agglutinated by their claws to the staminiferous tube. The analysis of the flower, and a drawing of the fruit in its natural size, are shown in Plate XIV. figs. 4–9.

The *Barringtonia racemosa* of Blume (non Juss.) is considered by Miquel to be the same as Horsfield's plant from Patjetan and Banca, which is here regarded as identical with Rumphius's plant from Amboyna, in the same region. Blume's species, *B. racemosa*, in Van Houtte's Flora, is a heterogeneous mixture of plants from all quarters.

There can therefore be no hesitation in placing under this species the Java plants enumerated by Blume and Miquel under the name of *B. racemosa*, that species being confined to the Indian peninsula and Ceylon.

5. Butonica rubra, nob.: *Butonica Tsjeria Saamstravadi*, Rheede, Hort. Malab. part iv. p. 15, tab. 7: *Eugenia acutangula*, Linn. (in parte), Sp. Pl. i. 471: *Stravadium rubrum*, DC. (in parte), Prodr. iii. 289: *Stravadia rubra*, Pers. (in parte), Ench. i. 30: *Barringtonia rubra*, Bl. in Van Houtte, Fl. Serr. vii. 23: arbor alta, ramulis pallide brunneis, lignosis, angulatis, rugulosis: foliis approximatis, ellipticis, apice in acumen acutum subito constrictis, infra medium spathulato-angustatis, circa petiolum repente rotundato-truncatis, obsolete et obtuse serratis, chartaceis, supra sæpe pallidissimis, albidule opacissimis, aut pallide viridibus, nervis patenti-divaricatis venisque transversim reticulatis vix prominulis, costa plana, tenuiter carinata, et imo subdilatata, subtus pallidis, opacis, costa striolata nervisque prominulis; petiolo latiusculo, supra plano, subtus convexo et striolato, limbo 20plo breviore: racemo terminali, longissimo, pendulo, remote plurifloro; floribus tenuiter pedicellatis; calycis limbo mediocri, globoso, demum in lobos 3–4 oblongos subcoriaceos parallele nervosos opace granulosos rupto; petalis 4, duplo vel triplo longioribus, oblongis, purpureis; staminibus, disco styloque ut in char. gen.; ovario infero, turbinato, 4-loculari, ovulis in quoque loculo 2 suspensis: fructu oblongo, utrinque rotundato, calyce coronato, sub-4-gono, angulis rotundatis, abortu 1-loculari et monospermo; pericarpio crassissimo; semine cylindrico. In penins. Indiæ: *v. s. in hb. Hook.* Quilon (*Wight* 1064), Concan (*Horter*); *in hb. Soc. Linn.* hort. Calc. cult. (Wall. Cat. 3634 c).

This is a second exclusively Indian species, sufficiently well described by Rheede, which has been strangely confounded with Rumphius's *B. terrestris* from Amboyna and Java, and also with *Stravadium acutangulum*, by all botanists. The mistake originated with Linnæus, who confounded Rumphius's plant with Hermann's, and was unacquainted with any of the plants mentioned by him as synonyms. It is, however, a well-marked species. Rheede describes it as a tall tree; but his drawing of a fruit-bearing branch, being reduced to half its due proportions, renders it difficult of recognition. It differs, however, from *B. terrestris* in its much shorter and much broader leaves; and its fruit, though somewhat similar, is longer and narrower. It differs from *B. racemosa* for the same reasons. It bears no resemblance whatever to *Stravadium acutangulum*. Its leaves, about $\frac{3}{4}$ in. apart, are $6\frac{1}{2}$–$8\frac{1}{2}$ in. long, $3\frac{1}{4}$–4 in. broad, on petioles 4–5 lines long; the slender raceme is 28–36 in. long; the slender pedicels, $\frac{1}{2}$ in. apart, are 3 lines long; the calycine limb is globular and entire in the bud, 5 lines in diameter, soon splitting into 3 equal lobes; the petals are 9 lines long; the outer series of filaments are 11 lines long, the inner series being gradually shorter. The fruit, as shown in Rheede's drawing, when restored to its proper size, would be $3\frac{1}{2}$ in. long, $1\frac{1}{2}$ in. broad, of an oblong shape, rounded at both ends, quadrately cylindrical, with obtuse angles, with a thick pericarp enclosing a cylindrical nucleus, said to be of a sweetish taste at first, but afterwards having an unpleasant bitter flavour. The fruit in its natural dimensions is shown in Plate XIV. fig. 2, the flower in fig. 1.

6. Butonica alata, nob.: *Barringtonia alata*, Wall. Cat. (non Miq.); Griffith, Notulæ, iv. p. 636; Icon. Pl. Asiat. tab. 636. figs. 1–6 (in errore sub *Barringtonia conoidea*):

fruticosa, ramulis brunneis, pallide glaucis, interrupte striatis, apice confertim foliosis; foliis oblongis, apice in acumen breve obtusum constrictis, basin versus angustatis et subito rotundiusculis, obsolete serratis, dentibus obtusissimis, chartaceis, supra profunde viridibus, opacis, nervis vix prominulis, subtus pallidioribus, opacis, costa nervis venisque reticulatis prominulis; petiolo latiusculo, limbo 40plo breviore: racemis axillaribus, subspicatim erectis, folio dimidio vel bis triente brevioribus, subpaucifloris; pedicellis tenuiter teretibus, imo articulatis et minute bibracteolatis; calycis limbo mediocri, primum globoso-ovato, apice mucronulato, demum in lobos 2, dein in 4, rupto; petalis 4, oblongo-lanceolatis, carnosulis, albide carneis; staminibus, disco styloque ut in char. gen.; ovario infero, conico-cylindrico, 6-sulcato, imo umbilicato et 6-lobo, 4-loculari, ovulis in quoque loculo 2 suspensis: drupa majuscula, conice elongata, imo profunde umbilicata, apice 6-sulcata et calyce coronata, basin versus in lobos 6 crasse alatos pendentes expansa, 1-loculari, abortu 1-sperma; pericarpio sicco, fibroso; semine majusculo, ovato, 6-sulcato, ab apice pendulo; embryone conformi, homogeneo, neorhiza interna conspicua. In Malacca: *v. s. in herb. Hook.* Mergui (*Griffith*); *in hb. Soc. Linn.* Moulmein (*Wall. Cat.* 3633); *v. fruct. in Mus. Soc. Linn.* (*Wallich*).

We have no published account or manuscript details of this remarkable species. Griffith's analysis of its fruits, which agrees with all I found in Wallich's specimen (as shown here in Plate XIV.), is figured in his work in plate 636 B, figs. 1 and 6, through the mistake of the editor of the 'Notulæ,' under the name of *Barringtonia conoidea*, while the fruit of the latter is not represented by him, though it is well described in a manuscript note attached by him to his specimen of the plant.

The leaves are 7–10 in. long, $2\frac{1}{2}$–$3\frac{1}{2}$ in. broad, on a rather wide flat petiole $1\frac{1}{2}$–2 lines long, and they have about 11 pairs of curving subascending nerves; the racemes are 3–4 in. long, with a slender, erect, compressed, striolated, brownish-opaque rachis, bearing alternate flowers $\frac{3}{4}$ in. apart; the slender subnutant pedicels are 9 lines long; the calycine lobes, after bursting, are $4\frac{1}{2}$ lines long, 2–3 lines broad, pruinosely opaque, concave; petals pruinose outside; the fruit, including the wings, which descend $\frac{3}{4}$ in. below the top of the pedicel, is $2\frac{1}{2}$ in. long, $\frac{3}{8}$ in. near the apex, gradually widening to a breadth of 2 in. across the six compressed subcoriaceous wings; pericarp $1\frac{1}{2}$ line thick, with an oval cell somewhat narrow at the apex, the axis and dissepiments being pressed together on one side; seed oblong, 6-sulcated, suspended by a funicle, around which the abortive ovules are seen; the hard homogeneous nucleus is $1\frac{1}{2}$ in. long, 1 in. in diameter, the internal neorhiza having a diameter of half that size, and is partially free from the exorhiza, showing a sensible interval between them. An analysis of Wallich's specimen of the fruit is shown in Plate XIV. figs. 13, 14.

7. Butonica inclyta, nob.: *Barringtonia racemosa*, Griffith (non Bl. nec alior.), Notulæ, p. 659; Icon. Pl. Asiat. tab. 636. 2 (non 1). fig. 1 ad 6: ramulis subtenuibus, apice, crebre foliosis: foliis mediocribus, obverse obovato-oblongis, apice valde obtusis aut rotundatis, sæpe emarginatis, infra medium subcuneatim angus-

tatis, circa petiolum subito anguste rotundiusculis, marginibus subintegris, valde revolutis et subretuse undulatis, subcoriaceis, supra pallide viridibus, valde opacis, ruguloso-granulatis, nervis adscendenti-divaricatis, semiimmersis, reticulatis, subtus rufescenti-pallidis, opacis, nervis venis costaque plana et striolata prominulis; petiolo brevissimo, aut vix ullo: racemo axillari; floribus ignotis: fructu majusculo, obpyriformi-oblongo, 8-sulcato, calyce coronato; pericarpio crassissimo, ligneo-fibroso, abortu 1-loculari et monospermo; semine magno, ab apice suspenso, 10-sulcato; testa subcoriacea, cum racheos ramis longitudinalibus in sulcos immersis; embryone conformi, mesopodo, apice in germinatione radicem pullulante, imo caulem novum emittente (sec. cl. Griffith). In Malacca: *v. pl. s. in hb. Hook.* (*Griffith*) sine flore.

A species well distinguished by the size and shape of its leaves, and by the larger size of its fruit, which is differently constructed from that of *Butonica racemosa*, to which Griffith referred it. He gives no description whatever of his plant, but he figures the fruit. In his 'Notulæ' he states that he found 4 species of *Barringtonia* in Malacca:—1st, this plant, of which he sent home a specimen. 2nd, his *B. conoidea*, well represented separately in the plant, its inflorescence, and also in its fruit, in his plate 636, and which I have referred to *B. alata*. 3rd, *B. alata*, of which no account is given, but its fruit is well shown in his plate 635, and which his editor mistook for that of *B. conoidea*, confounding together Griffith's explanations of the two; both the fruit and specimens of the plant are manifestly identical with Wallich's plants of the same. 4th, *B. cylindrostachys*, which I have referred to the genus *Doxomma*. Its approximated leaves are $4\frac{1}{2}$–$6\frac{1}{2}$ in. long, 2–$2\frac{1}{2}$ in. broad, on broadish petioles, $1\frac{1}{2}$–2 lines long; a bare raceme is seen in the specimen, the rachis of which is 6 in. long, with cicatrices of the fallen flowers $\frac{1}{2}$ in. apart. The fruit in Griffith's drawing is large, $3\frac{1}{2}$ in. long, $2\frac{1}{2}$ in. in diam., rounded at the base, tapering a little above the middle, and crowned by the persistent calyx; the fibrous pericarp is 6 lines thick; the suspended seed as large as a fowl's egg, showing at its summit the abortive ovules, and the axis and abortive dissepiments pressed to one side, appearing like a thick longitudinal raphe; but the true raphe is seen in ten longitudinal branches imbedded in the thickish testa, which are opposite to as many furrows in the large embryo. This is drawn in its full size, showing the commencement of its germination by the protrusion of a small nipple in the summit, which afterwards expands into a root, while the bottom of the exorhiza splits to allow the exit of the extremity of the neorhiza, afterwards becoming the new stem, charged with scales; and upon this structure and on the mode of its germination, Griffith offers the remarks to which I have before alluded (p. 50). The fruit of this species is shown in Plate XIV. fig. 19.).

8. Butonica rosata, nob.: *Menichea rosata*, Sonnerat, Voy. Guin. (1776), p. 133, tab. 92, 93: arbor ramis crassis: foliis oblongo-lanceolatis, apice sensim acute acuminatis, imo longe cuneatis, obsolete serrulatis, petiolo brevi: racemis terminalibus vel e trunco enatis, nutantibus, folio subæquilongis; floribus alternis, pedicellatis; calyce demum in lobos 3 acutos rupto; petalis 4, albis, concavis, apice rotundatis; staminibus, disco styloque ut in char. gen.; ovario infero, turbinato, acute 4-gono, 4-locu-

lari: fructu oblongo-ovato, utrinque angustiore, 4-gono, obtuse angulato, breviter stipitato, calyce coronato; pericarpio roseo, carnosulo, abortu monospermo; semine ovali, apice acutiore, funiculo brevi sub apicem suspenso; testa parallele plurinervoso; embryone valde oleaginoso, eduli. In insulis Philippinis et Formosa: *v. pl. sic. in hb. Mus. Brit.* Formosa (*Oldham* 115).

This is described by Sonnerat as a tree growing in moist places at Sambouangue and elsewhere. Oldham's specimen from the adjoining island of Formosa agrees well with Sonnerat's drawing in plate 92, where the plant is represented in one third of its natural size, judging from the comparative dimensions of the calyx there shown—and in his plate 93, where it and the fruit are drawn in their proper dimensions. The leaves in Oldham's plant agree in shape and size with those of Sonnerat, restored to their full size: these are $8\frac{1}{2}$–9 in. long, $2\frac{3}{4}$–3 in. broad, on shortish petioles. The raceme, restored to its due size, is 9 inches long, bearing about 12 alternate flowers, on slender pedicels 6 lines long; the lobes of the calyx are 4 lines long, $2\frac{1}{2}$ lines broad. The fruit, shortly stipitate, is $3\frac{1}{4}$ in. long, 2 in. in diameter, with a rose-coloured subfleshy pericarp; its single seed is $2\frac{1}{8}$ in. long, $1\frac{1}{4}$ in. broad; according to Sonnerat, it is very oleaginous and edible, forming one of the best fruits of the island, where it is called *Jam rosata*. The fruit is shown in Plate XIV. fig. 17.

9. Butonica intermedia, nob.: *Barringtonia intermedia*, Vieillard, Bull. Soc. Linn. Normand. vol. x. p. 4: *Barringtonia racemosa*, Seem. (non Bl.), Flor. Viti. p. 683: *Eugenia racemosa*, Forst. (non Linn. nec DeCand.), Prodr. Fl. Austr. 39; Vieillard *l. c.* p. 9: arbuscula: foliis summo ramulorum dense confertis, lanceolato-oblongis, apice acutis, infra medium spathulato-angustatis, ad basin arctatam truncato-rotundatis, margine grosse crenatis vel obtuse serratis, conduplicatis, glabris, supra pallide viridibus, nervis subpatentibus paullo prominulis intra marginem arcuatim nexis, costa tenui, deorsum sensim incrassata, subtus pallidioribus, nervis cum aliis intermediis brevibus venisque valde reticulatis prominentibus, costa valida in petiolum brevissimum latum desinente: racemo terminali, pendulo, folio 3–4plo longiore; rachi subtenui, angulata, striata, pruinosa, basin versus bracteolata, mox sparse florifera; floribus mediocribus; pedicellis tenuibus, 4-gonis, nutantibus, imo bracteola lineari-lanceolata caducissima munitis; calycis limbo primum globoso, mucronato, integre clauso, demum in lobos 3–4 inæqualiter rupto; petalis 4, crassiusculis, albido-violaceis; staminibus numerosissimis, imo monadelphis, interioribus sæpe anantheris; ovario infero, turbinato, 4-gono, 4-loculari, ovulis in quoque loculo 4, pendulis: fructu oblongo, utrinque subalatim 4-angulato; pericarpio coriaceo, subtenui. In insulis Neo-Caledonia et Vitiensibus: *v. s. in hb. Hook.* Wagap (*Vieillard* 2239), Kanalak (*De Planche* 86, 87); *in hb. Mus. Brit.* New Caledonia (*Forster* sub *Eugenia racemosa*), New Caled. (*Anderson* sub *E. racemosa*), Fiji ins. Taviuni (*Seemann* 149).

A tree 10–20 feet high, according to Vieillard, found in maritime places or in running streams on the sea-coast (*Seemann*). The leaves in all the above specimens resemble each other in their shape and venation, varying from 10 to 15 in. long, $2\frac{7}{8}$–$3\frac{1}{4}$ in. broad, on

petioles 1–2 lines long; the racemes, in the specimens, are 10–19 in. long; but Vieillard says they are often found $2\frac{1}{2}$ to 3 feet in length: he also states they are sericeous; but in his specimen, as well as in all the others, they are glabrous and pruinosely opaque; the slender pedicels, $\frac{3}{4}$ in. apart, are generally $\frac{3}{4}$–1 in. long, shorter in the younger flowers; the globose calycine limb is $4\frac{1}{2}$ lines in diameter, and splits into 3 lobes 5 lines long; the petals are 1 in. long, 6 lines broad, with the lateral margins retroflected; the ovary is $2\frac{1}{2}$ lines long, with 4 almost winged angles. Seemann's specimen of the fruit, apparently not ripe, accords with the description of Vieillard; it is oblong, acute at base, narrowed above, 2 in. long, $\frac{3}{4}$ in. broad, crowned by calycine lobes, narrowly winged on its angles, and contains a single suspended seed with a mesopodal embryo. This fruit, according to Seemann, is poisonous, and used for stupifying fishes; it is called Vutu-ui-wai (Water-vutu).

10. Butonica procera, nob.: *Barringtonia excelsa*, Benth. (non Bl.), Lond. Journ. Bot. ii. 221: arbor elata, ramulis in summo crebre foliosis: foliis majusculis, elongato-oblongis, apice breviter aut sensim acuminatis, infra medium spathulato-angustatis, imo obtusis vel rotundato-truncatis, marginibus revolutis, sub medium integris, superne crenato-serratis, chartaceis, supra pallide viridibus, opacis, nervis conspicuis divaricatis intra marginem nexis, costa supra plana, versus imum sensim incrassata, subtus pallidioribus; petiolo vix ullo: racemo subterminali solitario (vel interdum 3 subaxillaribus congestim approximatis); rachi longissima, pendula, folio triplo longiore, glabra, acute angulata, striata; floribus inferioribus sparsis, superioribus crebrioribus; pedicellis brevissimis, crassis, ebracteatis, floribus hinc subsessilibus; calycis limbo primum globoso, integre clauso, dein in lobos 2 apice sæpe bifidos coriaceos concavos pruinosos extus granulatos rupto; petalis 4, triplo longioribus, oblongo-ovatis, albis, membranaceis, lateribus subretroflexis, unguibus tubo staminifero agglutinatis; staminibus, disco styloque ut in char. gen.; ovario infero, cylindrico, medio ventricoso, 8-costato, cinereo-pruinoso, 4-loculari, ovulis in quoque loculo 4 per paria axi pendulis: fructo ignoto. In insulis maris Pacifici: *v. s. in herb. Hook.* New Hebrides, in Tanna (*Hinds*); *in hb. Mus. Brit.* Tanna (*Hinds*).

A very peculiar species, referred by Mr. Bentham to *Barringtonia excelsa*, Bl., which is a very different plant. Hinds states that it is a large, lofty, handsome tree; it must not be confounded with specimens collected by Barclay at the same time in the same island, which I have referred to *B. samoënsis*. Its leaves are 12–18 in. long, $3\frac{1}{4}$–$5\frac{1}{4}$ in. broad, on petioles scarcely appreciable in length, being a short extension of the costa, 2 lines broad; the raceme is single, and nearly terminal in Hinds's specimen; but he remarks, in a note, that he had seen three of these spicated racemes forming only a part of a very magnificent cluster of flowers; the rachis in the specimen is as long as the leaves, somewhat slender, bearing many spicated flowers, almost sessile, the lower ones $1\frac{1}{2}$ in. apart, gradually closer upwards; the calycine lobes are 4 lines long; the petals 12 lines long, 5 lines broad; the outer series of stamens somewhat exceed the length of the petals; the circular disk supports on its outer margin the staminiferous tube; and its

inner margin rises in a short membranaceous erect tube, leaving a deep hollow, radiately striated, between it and the style.

11. Butonica samoënsis, nob.: *Barringtonia samoënsis*, A. Gray, Un.-St. Expl. Exped. p. 508; Walpers, Ann. iv. 852: *Barringtonia excelsa*, Gray (non. Bl. nec Benth.) *loc. cit.* p. 508: *Barringtonia racemosa*, Gaud. (non Bl.), Freyc. Voy. p. 483, tab. 107 (excl. syn.): *Stravadium insigne*, Bl. in Van Houtte, Flor. Serr. vii. p. 24, tab. 654, 655: *Barringtonia insignis*, Miq. in Flor. Ned. Ind. i. p. 488: *Barringtonia acutangula*, Bl. (non Roxb.), Bijdr. 1097, sec. Miq. *loc. cit.*: arbor, ramulis subcrassis, striatis: foliis subapproximatis, lanceolato- vel obovato-oblongis, apice acute attenuatis, imo sensim angustioribus et subobtusis, marginibus vix revolutis crenato-undulatis, subserratis, flaccidis, submembranaceis, supra viridibus, opacis, ad nervos sulcatis, nervis tenuibus adscendentibus venisque rubellis reticulatis paullo prominulis, subtus pallidioribus, opacis, minute granulatis, costa nervisque prominulis; petiolo semitereti, latiusculo, limbo 33plo breviore: racemo terminali, pendulo; rachi gracili, elongata; floribus speciosis, alternis, breviter pedicellatis; calycis limbo mediocri, primum integre globoso, demum in lobos 3–4 rupto; petalis 4, triplo longioribus, obtuse oblongis, subcrassis, marginibus membranaceis undulato-subrecurvatis; staminibus, disco styloque ut in char. gen.; ovario infero, turbinato, 4-gono, 4-loculari, ovulis in quoque loculo 4, suspensis: fructu longiuscule oblongo, utrinque acutiore, lobis calycinis coronato, 4-gono, angulis costatis, abortu 1-loculari et monospermo, semine suspenso, embryone mesopodo. In insulis Oceani Pacifici: *v. s. in hb. Hook.* Port Resolution, Tanna (*Barclay* 3487); *in hb. Mus. Brit.* Tanna (*Barclay*).

A species hitherto found only in the New Hebrides, Navigators', and the Ladrone or Mariana group of islands. It is said to be a tall handsome tree, growing in moist places; it is well represented in Gaudichaud's drawing, the leaves of which approach those of Dr. Gray's var. β. The plant is everywhere glabrous; the leaves are 8–15 in. (sometimes 24 in.) long, $2\frac{1}{2}$–$3\frac{1}{2}$ in. broad (in var. β $4\frac{1}{2}$ in. broad), on petioles 3 lines long and $1\frac{1}{2}$ line broad, with about 18 pairs of subascending nerves, with others shorter and intermediate, all anastomosing; the terminal raceme is 15–24 in. long, with a rather slender rachis, bearing alternate flowers $\frac{3}{4}$ in. apart, which, when expanded, are 2 in. across; pedicels 2–4 lines long; calycine limb at first globose, 3 lin. in diam., splits into 3–4 lobes; petals 10 lin. long, 5 lin. broad; the fruit, as shown in Gaudichaud's drawing, is 3 in. long, $1\frac{7}{8}$ in. broad, with 4 costate angles, decurrent on the pedicel. Gaudichaud's description of the seed is, that it is rostellated and bilobed at the apex. This would be better interpreted by saying that, as in all the other species, the seed is suspended by a funicle, to which the abortive ovules are also attached, and which seems lobed at its apex, as Griffith shows in his Icones, pl. 635. fig. 3. Van Houtte's drawing, tab. 654, to which he gave the name of *Stravadium insigne*, Bl., does not appear to have been made from any cultivated specimen, as he would lead us to suppose; its originality may indeed be doubted, after what I have shown in regard to his drawing, tab. 409, under *Barring-*

tonia speciosa. From the resemblance of the former, in the form and size of the leaf and the size of the flowers, we may infer that it is a made-up drawing, with its details borrowed from that of Gaudichaud. The analysis of the flower and the fruit are shown in Plate XIV. figs. 20–25.

12. Butonica edulis, nob.: *Barringtonia edulis*, Seem. Fl. Vit. p. 82: arborea: foliis elliptico-oblongis, apice sensim acutis, infra medium cuneatim angustatis, imo rotunde truncatis, marginibus cartilagineis subserratis cum punctis nigris in sinibus, flaccide chartaceis, supra pallide viridibus, nervis divaricatis fere recte adscendentibus paullo prominulis, venis tenuiter reticulatis, subtus subconcoloribus, nervis prominentibus, costa tenui striolata; petiolo late planato, brevissimo: racemis elongatis, pendulis, cinereo-tomentosis; rachi subangulata; floribus sparsis pedicellatis; calycis limbo primum globoso, clauso, apice mucronulato, cinereo-tomentoso, demum in lobos 3 vel 4 convexe rotundos longitudinaliter nervosos rupto; petalis 4, oblongis, utrinque attenuatis, glabris, albis; staminibus petalis longioribus; disco styloque ut in char. gen.; ovario infero, turbinato, 4-loculari, ovulis plurimis ab axi superne funiculis suspensis: fructu elongato-oblongo, utrinque obtuso, ambitu rotundo (nec 4-gono), eduli. In insulis Oceani Pacifici: *v. s. in hb. Mus. Brit. et Hook.* Fiji, Vutu-kana (*Seemann* 150), Viti (*Seemann*); *v. fr. in Museo Kew.* (*Seemann*).

A species near *B. intermedia*, differing in its broader leaves, with dissimilar nerves, its tomentose raceme with larger flowers. It is a tree 30–40 feet high, of erect growth; its leaves are 9–14 inches long, $3\frac{1}{4}$–5 in. broad, on petioles 1–2 lines long and broad; the raceme is about 10 in. long; rachis 1 line thick; flowers $\frac{1}{4}$–$\frac{1}{2}$ in. apart; pedicels 2 lines long; calycine limb in bud 4 lines in diameter; petals $1\frac{1}{4}$ in. long, 5 lines broad; stamens $1\frac{1}{2}$ in. long: the fruit in Seemann's specimen is $2\frac{3}{4}$ in. long, $1\frac{1}{2}$ in broad, crowned by the persistent calyx, and distinctly rounded, not acutely 4-gonous, as in the two other species growing in the island; the largest he saw, in a more mature state, was 4 in. long, $1\frac{1}{2}$ in. across. The seed is eaten by the natives either when cooked or in the raw state, while in the other species it is poisonous. Seemann wrongly describes the calyx to consist of 4 rounded sepals, and did not notice that it is at first globose and entire, afterwards splitting into 3 or 4 lobes. It is called *vutu-kana* or *vutu-kata.*

13. Butonica calyptrata, R. Br. MSS., in Benth. Austr. p. 287: ramulis crassis, cortice rimoso, e foliis lapsis cicatricibus majusculis creberrimis signatis: foliis superioribus mediocribus, reflexis, elongato-oblongis, apice ovatis aut rotundato-obtusis, imo sensim angustioribus, late acutis, marginibus tenuibus plicato-undulatis vix crenulatis, flaccide chartaceis, supra luride viridibus, in areolis glauco-opacis, nervis tenuibus rufulis prominulis reticulatis, subtus ferrugineo-pallidioribus, opacis, costa striolata nervisque paullo prominentibus; petiolo compresso, limbo 24plo breviore: racemo vix terminali; rachi crassiuscula, angulata, striata; floribus brevissime pedicellatis; calycis limbo primum globoso et integre clauso, rugose costatim nervoso, in lobos 2, dein in 4 rupto; petalis subparvis oblongis; stamini-

bus numerosis, imo breviter monadelphis; disco styloque ut in char. gen.; ovario infero, turbinato, 4-loculari, ovulis pluribus axi suspensis. In Australia: *v. s. in hb. Mus. Brit.* Lizard Island, New South Wales (*Banks and Solander*).

A very distinct species. Branchlets $\frac{1}{4}$–$\frac{3}{8}$ thick, singularly marked with crowded cicatrices of the fallen leaves; leaves 5–7 in. long, 2–$2\frac{3}{4}$ in. broad, on petioles $2\frac{1}{2}$–$3\frac{1}{2}$ lines long; rachis of spike more than 8 in. long; flowers about $\frac{3}{8}$ in. apart; pedicels $\frac{1}{2}$ line long; calyx in bud globose, 4 lines in diameter, lobes very thin and brittle, obtusely oblong, little longer than ovary; stamens very numerous, not very long, all antheriferous.

14. Butonica ceylanica, nob.: *Barringtonia ceylanica*, Gardn.: *Barringtonia racemosa*, Thwaites (non Linn. nec Roxb.), Enum. 119 (excl. syn. et icon. Wight): *Stravadium obtusangulum*, Bl. in Van Houtte, Fl. Serr. vii. p. 24: ramis crassis, pallide brunneis, vel cinereis: foliis in ramulis brevibus congestis, oblongis, apice sensim acutis aut in acumen breve subito constrictis, imo cuneatis, crenato-serratis, dentibus sæpe aciculatis, curvatim subplicatis, flaccide chartaceis, supra fusco-viridibus, opacis, nervis tenuibus remotiusculis divaricatis et valde arcuatim nexis, venisque transversis reticulatis prominulis, subtus flavide pallidioribus, nervis rufis venisque prominentibus; petiolo subplano, fusco, limbo 24plo breviore: racemis terminalibus, mox pendulis, folio 2–3plo longioribus; rachi tetragona, angulis rugosis, alternatim spicatiflora; pedicellis fuscis, tenuibus, calyce longioribus; calycis limbo ovali-globoso, integre clauso, demum in lobos 3 rotundatos rupto; petalis 4, triplo longioribus, oblongis, lateribus revolutis; staminibus, disco styloque ut in char. gen.; ovario infero, turbinato, tetragono, 4-loculari, ovulis in quoque loculo 2, suspensis: drupa immatura elongato-oblonga, utrinque subacuta, calyce coronata, abortu 1-loculari et 1-sperma. In Indiæ penins. et Ceylon: *v. s. in hb. Hook. et Mus. Brit.* Ceylon (*Thwaites* 2682); *in hb. Hook.* Indiæ penins. (*Rottler*).

This species, peculiar to Southern India and Ceylon, grows in moist situations at an altitude of 1500 feet. Its leaves are 6–8 in. long, $2\frac{3}{4}$–3 in. broad, always acute at base, upon a broad stout petiole 3–4 lines long, and with about 15 pairs of nerves; slender raceme 12–15 in. long; slight angular pedicels about $\frac{1}{4}$–$\frac{1}{2}$ in. apart and 5–7 lines long; calyx in bud 3–4 lines long; petals 8–9 lines long, 5 lines broad, internal margin of disk more urceolate. The species is distinguishable from *Butonica racemosa* (to which it has been referred) by its smaller, more elliptic, less acuminated leaves, longer petioles, flowers smaller, on comparatively longer pedicels, an elongated fruit acute at both extremities: it is nearer *Butonica intermedia*. Mr. Thwaites makes two varieties of this species, principally because in the one the calyx is quite closed, and in the other slightly open at the apex. This appears to arise from the different ages of the raceme. In the younger buds the calyx is of course quite closed; in the more advanced stage the limb begins to open in the apex, and the pedicel lengthens. The thickish limb of the calyx splits irregularly nearly to the base into 3 or 4 lobes. The fruit, in section, is seen in one of Mr. Thwaites's specimens; it appears quite smooth, obtusely oblong, $1\frac{3}{4}$ in. long, $\frac{1}{2}$ in.

broad, with a pericarp 1 line thick, very different in size and shape from that of *B. racemosa.*

15. Butonica caffra, nob.: *Barringtonia caffra*, E. Mey. MSS.: *Barringtonia racemosa*, Oliv. (non Bl.) in Flor. Afr. ii. 438: ramulis crassiusculis, striolatis, fistulosis: foliis late vel elliptico-oblongis, apice sensim aut breviter acuminatis, infra medium gradatim angustioribus subcuneatis, marginibus cartilagineis subrevolutis, aut integris et crenulatis, vel punctis callosis obsolete dentatis, chartaceis, supra læte viridibus, nervis tenuibus patentim divaricatis et arcuatim nexis, subtus pallidioribus, costa valida, deorsum sensim incrassata, nervis venisque reticulatis prominentibus; petiolo semitereti, latiusculo, brevi: racemo terminali, longiusculo, pendulo; rachi subtenui angulata, striata; floribus spicatis, speciosis, subsparsis, pedicellis brevibus; calycis limbo primum globoso et integre clauso, demum in lobos sæpius 4 rupto; petalis 4, duplo vel triplo longioribus, oblongo-ovatis; staminibus, disco styloque ut in char. gen.; ovario infero, turbinato, subtetragono, ruguloso, 4-loculari, ovulis in quoque loculo 2 suspensis: fructu ovato-oblongo, lobis calycinis immutatis coronato, obsolete tetragono. In Africa australi: *v. s. in hb. Hook.* fluv. Zambesi (*Miller*), fluv. Rovuma (*Miller*), fl. Luaba (*Kirk*), Zanguebar (*Kirk* 78), S. Africa (*Drège*); *v. fruct.* in Mus. Kew. (*Kirk* 78).

A large tree, according to Miller, who found it growing along the banks of the Rovuma over an extent of twenty miles. It is very distinct from the Indian species *B. racemosa.* The branches are closely covered at the extremities by large leaves, which soon fall off and leave large cicatrices at the points of their insertion 3 lines apart; the leaves are 8–17 in. long, $2\frac{3}{4}$–$4\frac{1}{2}$ in. broad, on petioles seldom more than 1 line long and broad, and have about 18 pairs of rather straight divaricating nerves; the raceme is 18–30 in. long, the pedicels about $\frac{1}{2}$ in. apart and 2–3 lines long; the calycine limb is globular and entire in the bud, is 3–4 lines in diameter, the petals about 9 lines long. The fruit collected by Dr. Kirk is oval, slightly narrowing at each extremity, obsoletely 4-angled, crowned by the unchanged calycine lobes, is 2 in. long, $1\frac{1}{4}$ in. broad, and contains a single seed, as in other species of this genus. The leaves in Drège's specimen are longer and broader than in the others, and probably may be regarded as a variety.

16. Butonica apiculata, nob.: ramulis crassiusculis, rugosis, striatis, summo crebre foliosis: foliis oblongis, apice in acumen breve acutum subito constrictis, imo cuneatis, obtuse et breviter serratis, chartaceis, supra viridibus, nervis tenuibus utrinque circiter 10 cum aliis brevioribus interjectis, prominulis, costa tenui, subtus paullo pallidioribus, subopacis, costa prominente; petiolo limbo 15–20plo breviore: racemo terminali, brevi; rachi angulata, compressa, striata, opaca; floribus approximatis, breviter pedicellatis; calyce globoso, integro, demum in lobos 4 rupto; ovario infero, 4-loculari, ovulis 2 in quoque loculo suspensis: fructu immaturo oblongo, 4-angulari, utrinque subacuto, lobis calycinis 4 coronato. In Madagascar: *v. s. in hb. Hook.* loc. cit. (*Pervillé*).

A species collected by Capt. Pervillé in Madagascar. It is distinguished from the

preceding by its smaller leaves sharply spiculated, with fewer nerves and a longer petiole, a much shorter and stouter raceme. Its leaves are 5–6 in. long, $2\frac{1}{4}$–$2\frac{3}{4}$ in. broad, on a petiole 3–5 lines long; the rachis of the raceme is 13 in. long, and bears alternate flowers $\frac{3}{4}$–1 in. apart, on pedicels 2 lines long. The flowers had all fallen away, leaving some half-grown ovaries or immature fruits 7 lines long, crowned by 4 calycine lobes 3 lines long.

4. Stravadium.

This genus is maintained by very efficient and unmistakable characters. It was established by Jussieu in 1709 [1] upon the *Tsjeria Saamstravadi* of Rheede [2] and a few other species. It was acknowledged by Blume [3] and DeCandolle [4], but rejected by Roxburgh and other botanists, who conjoined it with a group of species under a genus called *Barringtonia*, very different from the true *Barringtonia* of Forster; and hence have arisen the many complications that followed. Miquel attempted a monograph of the family [5], which has created still further confusion among the species. He enumerated under *Barringtonia* 17 species [6], apportioning them into 2 sections, *Butonica* and *Stravadium*, after the example of Endlicher [7], by characters so loose that he quite disregarded them in the arrangement of his species, and he thus rejected *Stravadium* as a genus. Blume at a later period still acknowledged *Stravadium* [8], enumerating 11 species, the first 6 of which only can be retained. The authors of the 'Genera Plantarum' adopted entirely [9] the views of Miquel.

We must attribute all these discrepancies to the entire disregard shown by most authors to the structure of the free portion of the calyx. The difference is well marked in several cases, where this free portion is vesicular and entire in the bud, but is soon ruptured by the pressure of the petals into 2, 3, or 4 lobes, which are either very large or moderately small—characters constant in the genera *Barringtonia*, *Agasta*, and *Butonica*; on the other hand, in *Stravadium* this calycine border is divided, even in the bud, into 4 small rounded ciliolated sepals, somewhat imbricated in æstivation, as in *Carya* and *Planchonia*. It is easy, therefore, without the possibility of mistake, to detect at once any species of *Stravadium*, a genus distinguished by the presence of 4 free sepals in the calycine border, an ovary constantly 2-celled, with 2 suspended ovules in each cell, producing an oblong, subtetragonous, indehiscent fruit, which by abortion is 1-celled, with a single large seed that fills the cell, and that consists of an exalbuminous embryo, like that already described in *Butonica*.

We may regard the *Eugenia acutangula* of Linnæus as the type of the genus, with which many other different species have been confounded by botanists under the name of *Barringtonia acutangula*.

[1] Gen. p. 326.
[2] Hort. Malab. iv. p. 15, tab. 7.
[3] Bydr. 1097.
[4] Prodr. 3239.
[5] Fl. Ned. Ind. i. 485.
[6] Van Houtte, Fl. Serr. vii. p. 23.
[7] Gen. Pl. p. 1233. no. 6325.
[8] Van Houtte, Fl. Serr. vii. p. 23.
[9] Gen. Pl. i. 720.

STRAVADIUM, Jussieu.

Stravadia, Pers.; *Meteorus*, Lour.; *Butonica* (in parte), Rumph.; *Barringtonia* (in parte), Miquel et alior.; *Botryoropis*, Presl.

Calycis adnati *limbus* 4-sepalus: *sepala* parva, rotundata, membranacea, sæpius ciliata, æstivatione subimbricata, persistentia. *Petala* 4, oblonga, 3–4plo longiora, unguibus tubo staminigero affixa et cum illo caduca. *Stamina* numerosissima, multiseriata, imo breviter in tubum erectum monadelpha: *filamenta* filiformia, petala vix excedentia, æqualia, omnia antherifera. *Stylus* tenuiter subulatus, paullo incurvus, eorum longitudine: *stigma* parvum, clavatum: *ovarium* inferum, turbinatum, sæpius 4-angulatum, semper 2-loculare, vertice intra discum valde concavum; *ovula* in quoque loculo 2, ab apice funiculo brevi suspensa. *Fructus* oblongus, plus minusve elongatus, tetragonus, angulis sæpius costatis, calyce coronatus, abortione 1-locularis et monospermus: *pericarpium* subcrassum, coriaceum, fibrosum: *semen* loculum implens, apice suspensum, homogeneum, structura ei *Butonicæ* simile.

Arbores *in India orientali, Malacca, Archipelago Asiat. et Australia vigentes, sæpius mediocres:* folia *oblonga, utrinque acuta, serrata, petiolata:* racemi *terminales, longe spicati:* flores *subparvi.*

1. STRAVADIUM ACUTANGULUM, nob.: *Eugenia acutangula*, Linn. Sp. Pl. i. 673 (excl. syn.); Syst. Veg. i. 461; Flor. Zeyl. p. 85. no. 190 (excl. synon. in Pl. Hermann. iv. p. 50); Willd. Sp. ii. 966 (excl. syn.): *Barringtonia acutangula*, Gaertn. Fruct. ii. 97, tab. 101; Roxb. Fl. Ind. ii. 635 (exclus. syn. Lour. et Rumph.); Thwaites, Enum. p. 118 (in parte): foliis in apice ramulorum congestis, oblongis, apice obtusis aut subacutis, infra medium sensim cuneatis, chartaceis, margine crenato-serrulatis, dentibus obtusis sæpe aciculato-mucronatis, glabris, supra viridibus, minute granulosis, nervis tenuissimis venisque reticulatis semiimmersis, subtus cinereo-glaucis, opacis, nervis venisque prominulis; petiolo semitereti, supra plano, subtus corruguloso, limbo 10plo breviore: racemo terminali, spicato, mox pendulo, folio 6plo longiore; floribus parvis, subsparsis, brevissime pedicellatis, glabris; sepalis 4 (rarissime 3), ovatis, erectis, marginibus membranaceis acute serrulatis; petalis 4, obovatis, 3plo longioribus, membranaceis; ovario infero, turbinato, acute 4-angulari, 2-loculari: fructu (sec. Gaertn.) oblongo-ellipsoideo, tetragono, angulis crasse costatis, utrinque attenuato, calyce coronato, 1-loculari et monospermo, semine ut in char. gen. et 4-partibili. In Ceylonia: *v. s. in hb. Mus. Brit.; in hb. Hermanni, loc. cit. specimen typicum Linnæi*, Ceylon (*Thwaites* 1572).

In the typical specimen the leaves are $1\frac{1}{2}$–$2\frac{1}{2}$ in. long, $\frac{3}{4}$–$1\frac{1}{4}$ in. broad, on petioles 2–3 lines long; raceme 13 in. long; pedicels 1 line long; sepals $\frac{3}{4}$ line, petals $2\frac{1}{2}$ lines long.

Gaertner's figure of the fruit is from a specimen in the Leyden Museum, which came from Ceylon under the vernacular name *Medella*, the same as mentioned by Thwaites, and was probably contributed by Hermann to the Leyden collection, as he published there his work on the Ceylon flora. It is $1\frac{3}{4}$ in. long, $\frac{3}{4}$ in. broad across the prominent angles; the seed is oblong, subtetragonous, rounded at base, subacute at the apex, 13 lines long, 6 lines broad, the external portion (exorhiza) splitting into 4 parts along the sides. The plant in Ceylon bears the vernacular name of *Ella-medella-gass.*

Drawings of the typical plant, its flower, fruit, and seed, are shown in Plate XVII. figs. 1–14.

2. STRAVADIUM OBTUSANGULUM, Blume, in V. Houtte, Fl. Serr. vii. p. 24 (excl. syn.): *Barringtonia obtusangula*, Miq. Flor. Ned. Ind. i. 491: *Barringtonia acutangula*, Thwaites (non Gaertn.) (in parte), Enum. p. 119: ramulis brunneis, remote lenticellatis: foliis oblongo-ellipticis, apice obtusis, raro vix acutioribus, imo sensim cuneatis, retuse serratis, dentibus obtusis, subrigide chartaceis, supra fusco-viridibus, costa tenui, nervis subadscendentibus venisque granulatis valde reticulatis prominentibus, subtus ferrugineo-opacis, costa nervisque prominentibus; petiolo fusco, sulcato, late marginato, limbo 12plo breviore: racemo terminali, spicato, folio longiore; rachi tenui, subflexuosa, angulata, glauco-pruinosa; floribus subparvis, subapproximatis, pedicellatis; sepalis 4, rotundatis, carnosis, margine membranaceo minute denticulatis; petalis 4, oblongis; ovario infero, turbinato, acute 4-angulato, ruguloso, fusco: fructu (sec. Bl.) elongato-ellipsoideo, utrinque subattenuato, obtuse tetragono, angulis incrassatis. In Ceylonia: *v. s. in hb. Mus. Brit.* Thwaites, 1592: *fruct. non vidi.*

This species differs from the preceding in its longer, broader, more obversely elliptic, much darker, more glabrous leaves, of very different aspect. They are 3–5 in. long, $1\frac{1}{2}$–2 in. broad, on petioles 3–4 lines long; its raceme is 3–10 in. long; flowers 2–3 lines apart, sometimes more aggregated, upon pedicels 1–2 lines long; sepals $\frac{1}{2}$ line long; petals 2 lines long. Thwaites's specimen agrees well with Blume's description, drawn from a Ceylon plant collected by Royer. Miquel states in a haphazard way that it is identical with the *Planchonia valida* of Blume, which, according to the former, is merely a form of *Planchonia sundiaca*. This cannot be admitted; but it offers another proof of the continual contradictions between Miquel and Blume which serve to mislead us.

3. STRAVADIUM DEMISSUM, nob.: arbor demissa; ramulis tenuibus, pallide brunneis, striatis, apice confertim foliiferis: foliis elliptico-oblongis, sæpe subplicatim recurvulis, apice obtusatim acutis, imo sensim cuneatis, margine cartilagineo vix reflexo leviter sinuato-serratis, dentibus obtusis intus mucronulatis, firme chartaceis, supra opace viridibus, sub lente minutissime granulosis, nervis remotiusculis subadscendentibus semiimmersis reticulatis, costa tenui, subtus pallidis, opacis, sæpe dealbatis, costa, nervis venisque albescentibus et prominulis; petiolo semitereti, marginato, imo sæpe crassiore, limbo 12plo breviore: racemo terminali, sæpe longissimo, pendulo; rachi tenuissima, fusca, striolata, spicatiflora; floribus pro genere majoribus, sparsis, pedicellis bractea longiore refracta cuneato-lanceolata acute denticulata membranacea glabra munitis; sepalis 4, rotundato-ovatis, fuscis, sparse puberulis, marginibus membranaceis, ciliolatis; petalis 4, quintuplo longioribus, oblongo-obovatis, membranaceis, carneo vel pallide rubellis, extus subpruinosis, unguibus tubo staminigero extus adglutinatis; ovario infero, turbinato, acute tetragono, 2-loculari, ovulis in quoque loculo 2, apice suspensis: fructu immaturo oblongo, imo obtuso, apice calyce coronato, acute quadrato, angulis subcrenatis, abortu 1-loculari et monospermo. In Malacca et in insulis Malayensibus: *v. s. in herb. Hook.* Assam (*Masters* 363), Tenasserim et Andaman (*Helfors* 2422–2425) Malacca (*Griffith*), Malay penins. (*Griffith* 74), hort. cult. Calc. (*Griffith* 2425),

Mergui (*Griffith*); *in herb. Soc. Linn.* Amherst (*Wall. Cat.* 3635 C); Guayalpoor (*Wall. Cat.* 3635 A), Chittagong (*Wall. Cat.* 3635 D).

This species is said by Griffith to be a low tree, growing in moist woods, over all the Malayan provinces. Its branches are slender, with leaves crowded at their extremities, with axils 2–3 lines apart. The leaves are $3\frac{1}{2}$–5 in. long, $1\frac{1}{2}$–2 in. broad, on petioles 3–5 lines long; the raceme is 12–18 in. long, on a rachis $\frac{1}{4}$–$\frac{1}{2}$ line thick, with flowers 4–5 lines apart, on slender pedicels $1\frac{1}{2}$ line long, supported by a linear persistent bract 2 lines long; the sepals are 1 line long and broad, petals 5 lines long. The immature fruit, in Griffith's specimen, is $1\frac{1}{4}$ in. long, 8 lines broad, has 4 acute almost winged angles.

The species offers much resemblance to *S. Rheedii*, but differs in being of low stature, producing longer spicated racemes, which bear larger flowers on pedicels bracteated at their base, and in its fruit with almost winged crenulated angles.

4. Stravadium Rheedii, Blume in Van Houtte, Flor. Serr. vii. p. 24 (excl. synon.): *Barringtonia acutangula*, Roxb. (non Gaertn.) in parte, Fl. Ind. iii. p. 635 (excl. syn.); W. & A. Prodr. Fl. Ind. p. 335 (excl. syn.): *Eugenia racemosa*, Roxb. (non Linn.), Icon. E. I. C. Mus. tab. 149: arbor valida, ramosa, ramulis tenuibus, valde rugosis, pallide brunneis, striatis, cortice crasso, fusco, asperato: foliis subconfertis, elliptico- vel spathulato-oblongis, apice obtuse acuminatis, raro acutioribus, imo cuneatis, serrulatis, dentibus obtusis sæpe mucronulatis, rigide chartaceis vel subcoriaceis, supra saturate viridibus vel pallidioribus, opacis, sub lente (præsertim in nervis) granulis minutis asperatis, nervis tenuibus paullo prominulis, costa subimmersa, subtus pallidioribus, opacis, sæpe dealbatis, glaucis vel fulvidis, nervis costaque prominulis reticulatis; petiolo supra plano aut sulcato, marginato, subtus corrugulato, limbo 15–20plo breviore: racemo terminali, spicatifloro, pendulo, folio duplo aut ultra longiore; rachi subtenui; floribus subapproximatis, longiuscule pedicellatis; sepalis 4, ovatis, membranaceis, ciliatis; petalis 6plo longioribus, 4, oblongis, carneis vel intense rubris, extus carinatis, marginibus ciliatis; staminibus coccineis; ovario infero, turbinato, acute 4-angulato, 2-loculari, ovulis in loculis suspensis: fructu oblongo, utrinque subangustiore, calyce coronato; pericarpio coriaceo, interrupte plurisulcato, acute tetragono, angulis tenuiter nerviformibus, abortu 1-loculari et monospermo; semine oblongo, profunde parallele sulcato, solido. Arbores in Indiæ peninsula undique sparsæ: *v. s. in herb. Hook.* penins. Ind. (*Wight* 1083), Travancore (*Wight* 1062), Madras (*Wall. Cat.* 3635 G), N. W. Ind. (*Royle*), Serampore (*Edgeworth*), Afghanistan (*Ritchie* 286), in planit. Ganges (*Thompson*), in hort. Calc. cult. (*Griffith* 2424); *in hb. Soc. Linn.* hort. Calc. cult. (*Wall. Cat.* 3635 E), ex hb. Roxburgh (in *Wall. Cat.* 3635 F), ex hb. Finlayson (*Wall. Cat.* 3635 L); *in hb. Sir J. Smith.*

The several plants from all parts of the Indian peninsula above indicated are here considered to be the same as the *Barringtonia acutangula*, Roxb.; but they may require further revision.

Blume and Roxburgh looked upon this species as the *Tsjeria Saamstravadi* of Rheede (Hort. Mal. tab. 7); but they were misled into this opinion by the circum-

stance, not noticed by them, that the *Saamstravadi* in that place is reduced to half its natural size: that plant is the *Butonica rubra*, nob. (*ante*, p. 70). At the same time, Roxburgh, Wight, and others considered this species to be identical with the *Eugenia acutangula* of Linnæus and of Gaertner; but there is ample evidence to prove the contrary. This plant closely approaches *S. demissum*, a species apparently confined to the Malay provinces and adjoining islands; but it differs in its smaller and paler flowers. Roxburgh says it is a large handsome tree, in appearance like a regular and well-shaped middle-sized Oak, with slender branches; its leaves vary in size from 3–6½ in. long, 1⅜–2½ in. broad, on petioles 3–6 lines long; the raceme is 6–10 in. long, the flowers 3 lines apart, on pedicels 1–2 lines long; the sepals are ½ line long and broad, the petals 3 lines long; the immature fruit is 1¼ in. long, ½ in. broad; the embryo of the seed when in a fresh state has a savoury taste, but afterwards becomes bitter.

5. Stravadium pubescens, nob.: *Barringtonia acutangula*, W. & A. (non Roxb. nec Gaertn.), Prodr. Fl. Ind. p. 335 (in parte et excl. synon.): ramulis subangulatis, rugoso-striatis, ex cinereo vel rufescente brunneis, subpuberulis vel glauco-pruinosis: foliis elliptico-oblongis, apice latioribus, obtusis aut brevissime apiculatis, imo sensim subacutis, sæpe cuneatis, subserrulatis, dentibus mucronulatis, chartaceis, supra pallide viridibus, nervis tenuissimis subimmersis, venis transverse reticulatis, subtus sæpe pallidissimis, opacis, costa nervisque prominentibus, brevissime tomentellis, præsertim in nervis; petiolo subcrasso, imo latiusculo, puberulo, supra plano, limbo 10plo breviore: racemis sæpe in ramulis novellis brevibus terminalibus, folio 3–6plo longioribus, rachi tenui, angulata, griseo-puberula, spicatiflora; floribus pedicellatis; pedicellis imo bracteola parvula squamiformi æquilonga munitis; sepalis 4, parvis, rotundatis, extus puberulis, membranaceis, ciliatis; petalis 4, oblongis, triplo longioribus, pallide roseis, raro intensioribus; ovario infero, turbinato, tetragono, aspere puberulo, 2-loculari. In Indiæ peninsula: *v. s. in hb. Hook.* Coromandel (*Konig, Roxb. in Wall. Cat.* 3635 B), Concan (*Dalzell*), Carnatic (*G. Thompson*), Indiæ penins. (*Wight* 1062–1080), Courtallam (*Wight* 1063; *in Wall. Cat.* 3635, *ex hb. Wight*).

This species, which seems confined to the more southern provinces of the Peninsula, is very near the preceding, differing among other characters in its singular pubescence. Its leaves are 2½–5 in. long, 1½–2½ in. broad, on petioles 3–6 lines long; the racemes are 12–18 in. long, pedicels 1 line long, sepals ½ line long, petals 3 lines long; the fruit is unknown.

6. Stravadium coccineum, DC. Prodr. iii. 289: *Meteorus coccineus*, Lour. Coch. Chin. ii. 449: arbor magna, ramis tortuosis, adscendentibus, ramulis crebre striatis: foliis subsparsis, elliptico-oblongis vel obovatis, apice obtusis aut vix acutis, imo sensim cuneatis, ad marginem subintegrum obsolete crenato-serrulatis, rigide chartaceis, supra subhepaticis, opacis, nervis rufulis costaque plana subprominulis valde reticulatis, subtus flavide opacis, sub lente minutissime granulatis, nervis flavescentibus costaque prominentibus; petiolo supra plano, limbo 12–16plo breviore: racemis

terminalibus, folio triplo longioribus, pendulis; rachi gracili, hepatica; floribus alternatim spicatis; pedicellis tenuibus, angulatis, fuscis, sepalis triplo longioribus; sepalis 4, parvis, ovatis, pallidis, marginibus membranaceis, ciliolatis, extus pulverulento-puberulis; petalis 4, triplo longioribus, oblongis, membranaceis, coccineis vel roseis, cum staminibus intense purpureis, disco styloque ut in char. gen.; ovario infero, turbinato, octagono angulis 4 acutioribus, vertice intra disci urceolum latum concavato, 2-loculari, ovulis in quoque loculo 2, suspensis: drupa late oblonga, obtuse octagona, glabra, fusca, calyce coronata, abortu 1-loculari et 1-sperma: semine magno, duro, rotundato. In Cochin-China: *v. s. in hb. Mus. Brit.* plantam typicam (*Loureiro*); *in hb. Hook.* Siam (*Schomb.* 182–309).

A tree of considerable size, growing in woods, very distinct from *Butonica terrestris*, with which it has been confounded. Its leaves are 4–5 in. long, $1\frac{3}{4}$–2 in. broad, on petioles 3–5 lines long, and with about 10 pairs of nerves. The racemes are 10–18 in. long, with flowers 3–5 lines apart, on pedicels 3 lines long, having a small deciduous bract at their base; the sepals are 1 line long, the petals 3 lines long; the size of the fruit is not stated. Loureiro describes the corolla as monopetalous, not observing that the petals were agglutinated to the staminiferous tube.

7. Stravadium luzonense, nob.: *Botryoropsis luzonensis*, Presl, Epim. Bot. p. 220; Miq. Fl. Ned. Ind. i. 492; Walp. Ann. ii. 642: ramulis dichotomis, subtenuibus, cinereo-brunneis, striolatis, apice confertim foliiferis: foliis oblongo-ellipticis, apice in acumen breve acutum constrictis, imo subcuneatis et in petiolo brevi decurrentibus, marginibus basin versus reflexis, undique serrulatis, dentibus erectis, subuncinatis, apice acute mucronulatis, flaccide chartaceis, supra rufescenti-viridulis, opacis, nervis arcuatim adscendentibus reticulatis, subtus pallidis, opacis, nervis paullo prominentibus; petiolo brevissimo, semitereti, acute marginato, limbo 30plo longiore: racemo terminali, longiusculo; rachi tenuissima, striolata, spicatiflora, rufescente, ebracteolata; floribus plurimis, pedicellatis; sepalis 4, rotundatis, margine late pallideque membranaceis, setulis rufulis ciliatis; petalis 4, oblongo-ovatis, 4plo longioribus, marginibus membranaceis, erosulis; filamentis hæc excedentibus, crenulato-crispatis; disco angustissime annulari, margine interno in tubum crassum erectum ore lato integrum expanso; ovario infero, turbinato, tetragono, angulis sepalis alternis, pedicelloque pilis rigidis rufulis puberulo, 2-loculari, ovulis 2 in quoque loculo apici dissepimenti affixis. In ins. Philippinis: *v. s. in hb. Hook. et Mus. Brit.* Laguna in Luzon (*Cuming* 653, 1268).

I have given the above diagnosis from my own observations. The genus *Botryoropsis* of Presl, formed on Cuming's plant (658), which I have carefully examined, differs in no respect from *Stravadium*. He was certainly wrong in attributing to it opposite branches and leaves; the 2-celled ovary and the broad tubular expansion of the inner margin of the disk are present in the preceding and all other species; indeed the latter feature differs only in degree, and is therefore of no more than specific value; the stamens are very numerous, and at least 6-seried; and the anthers differ in no respect from the others; the ovules are affixed to the summit of the dissepiment; in fine, there is no generic

distinction whatevever. This species differs from the preceding in little more than in its smaller and narrower leaves, which are $2\frac{1}{2}$–5 in. long, 1–2 in. broad, on petioles 1–2 lines long; the raceme is 9 in. long, the pedicels 1 line, the ovary $\frac{1}{2}$ line, the sepals 1 line, and the petals 3–4 lines long.

8. Stravadium spicatum, Blume, in DC. Prodr. iii. 289, et in Van Houtte, Flor. Serr. vii. 24: *Barringtonia spicata*, Blume, Bydr. 1097; Miq. Fl. Ned. Ind. i. 489; Vriese, Ned. Kruidk. Arch. iii. 41: ramulis rugosis, apice crebre foliosis: foliis longe ellipticis, apice sensim acutis aut breviter acuminatis, imo cuneatis, irregulariter crenato-serratis, dentibus obtusis aut subacutis, intus sæpe acute mucronulatis, tenuiter chartaceis, supra viridibus, opacis, nervis tenuissimis divaricatis vix prominulis, venis reticulatis, subtus pallidioribus, opacis, costa striolata nervisque prominulis; petiolo tenui, semitereti, limbo 20plo breviore: racemo terminali, longissimo, pendulo, rachi tenui, angulata; floribus spicatis, subcrebris vel sparsioribus; pedicellis brevibus; sepalis parvis, ovatis, pallide membranaceis, denticulis rubellis acutis ciliolatis; petalis 4, duplo longioribus, oblongis, unguiculatis, staminibus styloque ut in char. gen.; ovario turbinato, tetragono, 2-loculari, ovulis in quoque loculo 2, pendulis: fructu (sec. cl. Blume) ellipsoideo, utrinque obtuso, tetragono, costato-rugoso. In Javæ prov. Bantam, in sylvis paludosis: *v. s. in hb. Hook.* Java (*Zollinger* 534*), Java (*De Vriese*, sub *Barringtonia spicata*); *fruct. non vidi.*

A species distinct from *S. Horsfieldii* and *S. reticulatum*. Its leaves are 3–5 in. long, $1\frac{1}{2}$–2 in. broad, on petioles 4–6 lines long. Their dimensions agree with those given by Blume, who adds that they are sometimes (the lower ones?) 8 in. long and 3 in. broad; the slender rachis is 12–15 in. long, with rather small flowers, either sparsely or more thickly spicated. Blume asks whether this is the same as the *Carya macrostachya* of Jack, which certainly it is not, as the latter presents a thick cylindrical rachis, with much larger flowers, and belongs to the genus *Doxomma*. Miquel, with his usual carelessness, first copies the diagnosis of Blume as to the dimensions of the leaves, but afterwards, in contradiction, gives a much smaller size to the leaves—2 in. long, $1\frac{1}{2}$–2 in. broad, and therefore almost orbicular in shape.

9. Stravadium Horsfieldii, nob.: *Barringtonia Horsfieldii*, Miq. Fl. Ned. Ind. i. 489: ramulis tenuibus, ligneis, subfistulosis, rugulosis, axillis approximatis: foliis obovatis, apice rotundatis vel obtusatis et in acumen obtusulum breve latum subito constrictis, imo acute cuneatis, inæqualiter serrulato-dentatis, dentibus sæpe breviter spinuloso-mucronatis, subchartaceis, supra læte viridibus, opacis, nervis tenuissimis patule divaricatis paullo prominulis, subtus pallidioribus, nervis venisque reticulatis, prominulis; petiolo tenuissimo, semitereti, limbo 8plo breviore: racemo in ramulis brevibus alaribus terminali, spicato, folio 6plo longiore; rachi tenui, flexuosa, griseo-puberula, pluriflora; floribus alternis, sessilibus, imo bracteola decidua munitis; sepalis 4, distinctis, rotundatis, subito acutis, denticulatis, puberulis; petalis 4, ovato-oblongis, marginibus crenulatis 4plo longioribus; staminibus pluriseriatis,

imo altiuscule monadelphis; ovario infero, turbinato, subtetragono, biloculari, ovulis in quoque loculo 2, funiculis suspensis. In Java: *v. s. in hb. Mus. Brit. et Hook.* Prowatt (*Horsfield*).

A species near *S. spicatum,* but with much smaller leaves. In the above specimens the leaves are 3–4½ in. long, 1½–2½ in. broad, on petioles 5–6 lines long, with about 8 or 10 pairs of nerves; rachis of raceme 12–18 in. long; flowers frequently in pairs, 3–5 lines apart; sepals ½ line long; petals 4 lines long; ovary strigosely puberulous, yellowish. Miquel describes the leaves as being 2¾–4 in. long, ¾–1½ in. broad, on petioles ½ in. long, with 7–10 pairs of nerves.

10. Stravadium globosum, nob.: *Gustavia globosa,* Spanagh. Linn. xv. p. 204: *Perigara globosa,* Span. *l. c.* 204: ramulis subvalidis, fusco-opacis, striolatis: foliis oblongis, supra medium obtusis, apice in acumen breve subito constrictis, imo cuneatis, pallidissime opacis, crenato-serratis; petiolo semitereti, supra plano, limbo 10plo breviore: racemis axillaribus, folio longioribus; rachi gracili, pendula, pallide opaca, angulata, pilis albidis rigidulis scabridulis; floribus parvis, alternatim subsessilibus; sepalis rotundatis, membranaceis, dentibus rubidulis, fimbriatis, subpuberulis: ovario turbinato, rigide puberulo, 2-loculari: fructu parvo, globoso, abortu uniloculari, monospermo; semine globoso, ab apice suspenso. In Java: *v. s. in hb. Hook.* loc. cit. (*Anderson*), ex Hort. Bogor. cultam (sub nom. *S. spicatum*), cum fructu immaturo.

Leaves much approximated at the ends of the branchlets, 6–6½ in. long, 2½–2¾ in. broad, on slender petioles 7–8 lines long; acumen 2 lines long and broad; sepals 1 line long and broad; ovary 1 line long: fruit (probably immature) 8 lines in diameter; pericarp 1 line thick; immature seed 3 lines in diam., shown on a longitudinal section in the specimen above cited.

11. Stravadium gracile, nob.: *Barringtonia acutangula,* Benth. (non Gaertn.) Flor. Austr. iii. 288: arbor magna, ramulis tenuibus, apice creberrime foliosis: foliis elliptico-oblongis, apice sensim angustioribus, et in acumen breve obtusulum subito constrictis, imo gradatim cuneatis, margine breviter serrulatis, dentibus obtusis, callosis, flaccide chartaceis, utrinque pallidissimis, pruinoso-opacis, sub lente granuloso-punctulatis, costa nervisque tenuissimis, subarcuatim divaricatis paullo prominulis, reticulatis, subtus costa striolata nervisque albescentibus prominulis; petiolo tenui, planato, subtus striolato, limbo 36plo breviore: racemo terminali, spicato, longissimo, pendulo; rachi tenui, angulata, fusca, pluriflora; floribus pedicellatis; pedicellis longissimis tenuissimis e nodis globosis callosis albidis ortis, imo bractea majuscula cuneato-oblonga foliosa, dimidio breviore, alteraque minima rotundata membranacea squamiformi munitis; sepalis 4, ovatis, submembranaceis, denticulatis; petalis 4, oblongis, concavis, submembranaceis, denticulatis, rubellis; ovario infero, turbinato, fusco, acute tetragono, 2-loculari, ovulis in quoque loculo 2 suspensis: fructu ovato-oblongo, tetragono, angulis acutis utrinque sublobatis. In Australia septentrionali: *v. s. in hb. Hook.* Victoria River (*Mueller*), Adam's range (*Mueller*).

A large handsome tree: but there are probably two species here; for Mueller states that in one variety the larger perspicuous bracts are wanting, but the minute membranaceous rounded scales remain. The leaves are $2\frac{1}{2}$–$5\frac{1}{2}$ in. long, 1–2 in. broad, on petioles 3–4 lines long; the slender graceful raceme is 18 in. long, with flowers 2–3 lines apart; pedicels 6 lines long; bracts 4 lines long, 2 lines broad; sepals 3 lines long; petals 7 lines long; ovary 3 lines long; fruit $1\frac{1}{4}$ in. long, $\frac{3}{4}$ in. broad, pedicellated, of a brownish colour when dried.

12. Stravadium reticulatum, Bl. in Van Houtte, Flor. Serr. vii. p. 24: *Barringtonia reticulata*, Miq. Fl. Ind. i. 494: *Barringtonia acutangula*, Korth. (non Gaertn. nec Roxb.) in Kruidk. Arch. i. p. 296: ramulis pallide brunneis, opacis, striolatis: foliis oblongo-lanceolatis, apice sensim vel breviter acuminatis, imo cuneatim attenuatis, argute serratis, subcoriaceis, nervis utrinque circa 12 divaricato-adscendentibus, venis valde reticulatis, costa prominente, subtus pallidioribus; petiolo subtenui, supra plano, limbo 10plo breviore: racemo terminali, longe spicato, pendulo, folio 4plo longiore; floribus subapproximatis, pedicellis tenuibus, angulatis; sepalis 4, ovatis, membranaceis, denticulatis, medio crassioribus, pube brevissima asperatis; petalis 4, obovatis, 3plo longioribus, membranaceis, coccineis, integris, unguibus tubo staminigero adglutinatis, cæteris ut in char. gen.; ovario ovato, infero, rufulo, rigide puberulo, 2-loculari, ovulis in quoque loculo 2, dissepimento pendulis: fructu ellipsoideo, calyce coronato, acute 4-angulari, costis rugulosis. In Borneo in uliginosis et ins. Philippinis: *v. s. in hb. Hook.* Barmassing (*Motley* 53, 582, 720), ins. Phillipin. (*Cuming* 1835).

It is described as a small tree, with long slender racemes adorned with scarlet flowers. The fruit, which I have not seen, is said to be edible. The leaves are 5–$6\frac{1}{2}$ in. long, $1\frac{1}{2}$–2 in. broad, on petioles 6–9 lines long; the raceme is 18 in. long, with a slender subcompressed rachis, slender pedicels 3 lines long; the sepals are 1 line long; petals 3 lines long; stamens 4 lines long: the disk on its inner margin has a sharp elevated edge. In Blume's account there is a mistake in the length of the petioles, which are $\frac{1}{2}$–$\frac{3}{4}$ in., as Miquel rightly states.

13. Stravadium serratum, nob.: *Barringtonia serrata*, Miq. Fl. Ned. Ind. i. p. 488; Walp. Ann. iv. 851: foliis lanceolato-oblongis, apice in acumen breve obtuse acutum constrictis, imo cuneatis, marginibus imum versus repando-dentatis, summum versus subremote et argute spinuloso-serratis, flaccide chartaceis, nervis inferioribus tenuioribus patulis, reliquis validis et erecto-patulis, venis reticulatis: racemis elongatis, subpendulis; pedicellis sepalorum longitudine dupla; sepalis obtuse rotundatis et denticulatis; petalis flavido-roseis; ovario turbinato, tetragono, angulis prominulis. In Java, prov. Tjimarra: *non vidi.*

The leaves are 12–17 in. long, $3\frac{1}{2}$–$4\frac{1}{2}$ in. broad, on petioles $1\frac{1}{2}$–2 lines long; length of raceme not given; pedicels 6 lines long; sepals 3 lines long; number of cells in ovary not stated. From its ciliated sepals, we may infer that it belongs to *Stravadium.*

14. Stravadium Reinwardtii, nob.: *Barringtonia Reinwardtii*, Miq. in Fl. Ned. Ind. i. p. 488; Walp. Ann. iv. 851: foliis obverse oblongis vel obovato-oblongis, apice acuminatis, imum versus sensim attenuatis, tenuiter coriaceis, undique subspinulose serratis, nervis costatis utrinque circ. 12 erecto-patulis, venis reticulatis; petiolo brevissimo: racemo longissimo, pendulo, rachi crassiuscula; floribus pedicellatis; sepalis 4, obtusis, ciliato-erosulis; petalis late ellipticis, obtusis, superne tenerrime ciliolatis. In Java: *non vidi.*

Leaves 9–11 in. long, 3–4 in. broad, on petioles $1\frac{1}{2}$–2 lines long; raceme $2\frac{1}{2}$ feet long; pedicels 2–3 lines long; sepals about 3 lines long; petals nearly 1 inch long.

15. Stravadium costatum, Bl. in Van Houtte, Fl. Serr. vii. p. 24: *Barringtonia costata*, Miq. Fl. Ned. Ind. i. p. 489: foliis lanceolato-oblongis, apice acutis vel breviter acuminatis aut obtusioribus, imo cuneato-attenuatis, serrulatis, nervis costulatis; petiolo limbo 12plo breviore: racemis longissimis, pendulis; floribus pedicellatis, pro genere parvulis; petalis rubris: fructu obconico, subtetragono, costato. In ins. Sundaicis, sylvis humidis depressis: *non vidi.*

A species said to differ from *S. spicatum* in its smaller pedicellated flowers, and fruit attenuated at its base. Its leaves are 3–$6\frac{1}{2}$ in. long, 1–$2\frac{1}{2}$ in. broad, on petioles 3–6 lines long; racemes more than a foot long. Miquel has referred here the *Careya macrostachys* of Jack; but this mere guess cannot for a moment be entertained.

16. Stravadium lucidum, nob.: *Barringtonia nitida*, Miq. in Fl. Ned. Ind. i. 490: foliis obverse oblongis, obtusis vel obtusiusculis, imo attenuatis, irregulariter sinuato-serrulatis, tenuiter chartaceis, supra nitidis, costa tenui, nervis adscendenter divaricatis utrinque 8–12 tenuibus paullo prominulis, subtus pallidis, opacis, costa striolata prominula compressa, nervis venisque transversim reticulatis prominulis; petiolo semitereti late marginato, limbo 20plo breviore: racemis plurimis, spicatis, longissimis, pendulis, patule griseo-pubescentibus; floribus sessilibus; calycis limbo poculiformi in sepala 4 obtuse ovata diviso, pubescente, marginibus glabris membranaceis eroso-ciliatis; ovario adpresse hirtello. In Java: *v. s. in hb. Mus. Brit.* Bantam, prov. Sourabaja (*Horsfield*).

Horsfield's specimen agrees in character with Miquel's description of this plant (which is also from Bantam), only that the leaves are somewhat larger, and probably from a more matured specimen. They appear identical; but I have changed the specific name, that it may not be confounded with the *Planchonia nitida*, Bl. In Horsfield's plant the leaves are $3\frac{1}{2}$–$7\frac{1}{2}$ in. long, $2\frac{1}{2}$–$3\frac{3}{8}$ in. broad, on petioles 3–5 lines long; the racemes have all fallen off; only the bottom of one remains, bearing a single half-grown fruit. Miquel states that the leaves are $3\frac{1}{2}$–5 in. long, $1\frac{1}{2}$–$1\frac{3}{4}$ in. broad, on petioles 2–3 lines long; the racemes are 12–18 in. long.

17. Stravadium denticulatum, nob.: ramulis tenuibus, pallidis, sulcato-striatis; foliis lanceolato- vel longe oblongis, apice sensim acutis, imo cuneatis, margine subcrebre

serrulatis, chartaceis, supra pallide viridibus, opacis, nervis paullo divergentibus, subimmersis, tenuiter reticulatis, subtus pallidissimis, opacis, costa tenui, albida, prominula, nervis pallidissimis vix prominulis; petiolo angusto, utrinque marginato, subtus striolato, limbo 16plo breviore: racemo terminali, folio longiore, pendulo, glaberrimo, rachi subtenui, spicatiflora; pedicellis tenuissimis, 4-angulatis, sepalis longioribus; sepalis 4, ovatis, submembranaceis, marginibus undulatis, ciliato-denticulatis; petalis 4, triplo longioribus; staminibus numerosis, petalis multo longioribus, 4-seriatis; disco extus tubum staminigerum fulciente, interne in urceolam erectam ore latam et undulatam producto; stylo subulato, tenui; stigmate parvo, bilobo; ovario infero, parvo, acute 4-angulari, 2-loculari. In Australia: *v. s. in hb. Hook.* Cape York (*Hann* 195).

The leaves are 4–8$\frac{3}{4}$ in. long, 1$\frac{3}{8}$–3 in. broad, on petioles 3–6 lines long; raceme 11 in. long, with slender pedicels 4 lines long; sepals 1 line long; petals 3 lines long; stamens 7 lines long; style 7 lines; ovary 1 line long.

18. Stravadium semisutum, nob.: ramulis teneris, striolatis: foliis in summo ramulorum subconfertis, oblongo-ellipticis, apice sensim acutis aut breviter constrictis, infra medium subcuneatis, subserrulatis; petiolo subtenui, limbo 20plo breviore: racemo terminali, longissimo, pendulo, rachi tenui, angulato-striata, spicatiflora; floribus subsparsis, aut sæpe per paria approximatis, pedicellis tenuibus, patulis, sepalis æquilongis; sepalis obtuse oblongis, glabris, marginibus subrevolutis ciliatis, quorum 2 semper in unum latius semicoalitis; ovario infero, tetragono, sub-8-costato, disco plane annulari, intus in urceolam erectam crenulatam producto, vertice hinc profunde cavato, stylo subulato glabro sepalisque coronato, 2-loculari, ovulis in quoque loculo 2 suspensis. In Insulis Navigatorum: *v. s. in hb. Hook.* Falaga, Samoa (*Powell* 46).

A species remarkable for the semiagglutination of two of its four sepals, which are rather larger and thicker than usual in the genus; this seems to be a constant character, and apparently occurs in the following species from the neighbouring island of New Caledonia. The leaves, approximated on the branchlets, are 4$\frac{3}{4}$–7$\frac{1}{4}$ in. long, 2–2$\frac{3}{4}$ in. broad, on petioles 3–4 lines long: the slender terminal rachis is gradually bent till it becomes pendulous, is 20 in. long; the flowers are 1–5 lines apart, on spreading pedicels 2 lines long; the sepals are 3 lines long, the style 2$\frac{1}{2}$ lines long; the petals and stamens are all fallen off.

19. Stravadium integrifolium, Montrouzier in Mém. Acad. Lyon, vol. viii. (1858) p. 309: *Barringtonia Montrouzieri*, Vieill. in Bull. Soc. Linn. Normand. x. (1866) p. 11: arbor, foliis apice ramulorum confertis, obovato-oblongis, apice acuminatis, imo cuneatis, integerrimis, marginibus undulatis, glabris, reticulato-nervosis, vix petiolatis: racemis axillaribus, longe pendulis, laxifloris, bracteis imo involucratis; sepalis 2 v. 3 v. 4, subacute ovatis, concavis, marginibus apice coloratis; petalis 4, sepalis longioribus, albidis; staminibus disco styloque ut in char. gen.; ovario infero, turbinato, 2-loculari, ovulis in quoque loculo 2: fructu oblongo, compresso, sæpe arcuato,

4-angulari, angulis sinuato-alatis, abortu 1-loculari et monospermo. In Nova Caledonia et ins. Art, juxta rivulos: *non vidi.*

A tree 26–33 feet high, growing in valleys; its leaves are 7–8 in. long, $2\frac{1}{2}$–3 in. broad, and subsessile; its racemes are $1\frac{1}{2}$–2 feet long, with laxly spicated flowers; the fruit, with 4 very undulated wings, and crowned by the calycine lobes, is 5 in. long and $1\frac{1}{4}$ in. broad; the pericarp is fibrous, and, when the fruit has fallen to the ground, rots after a while, and a root protrudes like that of a radish. This species presents the peculiarity of the preceding species: of its sepals, often entire, two or three are sometimes partly conjoined.

5. Planchonia.

This genus, proposed by Blume, was first published in 1852, in Van Houtte's 'Flore des Serres;' he had, however, as far back as 1828, described its seminal features in De Candolle's 'Prodromus,' upon a plant referred by him to *Gustavia*, the seminal characters of which were then unknown. Long prior to this, the first known species of this genus was found in 1770, in Queensland, by Dr. Solander, and afterwards, in the Gulf of Carpentaria, by the late Mr. Robert Brown, who in 1803 discovered it to be a new genus, and then described the plant under the name of *Butonicoides crenata*, in a memoir never published, but which is still preserved in the British Museum. He changed its name to *Careya crenata* in 1819, when Roxburgh first established the latter genus, of which the internal structure of the seeds was unknown. *Planchonia* agrees with *Careya* in habit and the form of its fruit, which also contains many seeds, enveloped in pulp; but the embryo in the former is dicotyledonous, as in *Barringtonia*, while in *Careya* it is analogous to that of all other genera of the family. Brown's description of this genus is far more accurate and copious than that of Blume. Succeeding botanists gave very laconic characters of four or five species; but Miquel, in 1855, created confusion by combining them all into two species, with characters almost useless for the purpose of distinction. I have carefully examined Brown's typical plant, and have compared this with his original notes. With the analysis I have made of other, more recent specimens from another part of Australia, and from those materials, the following generic character is formed:—

Planchonia, Blume (olim *Gustavia*, Bl.).

Butonicoides, R. Br. MS.; *Careya* (in parte), R. Br. et Benth.; *Eugenia*, Soland. MSS.

Sepala 4, distincta, rotundata, subcoriacea, æstivatione paullo imbricata, persistentia. *Petala* 4, triplo longiora, cuneato-oblonga, reflexa, unguibus tubo staminifero agglutinata et cum illo caduca. *Stamina* numerosissima, pluriseriata, in tubum brevem monadelpha; *filamenta* filiformia, petalis longiora, æstivatione contortuplicata, nonnulla ananthera. *Discus* epigynus, plane annularis, margine externo tubum staminiferum fulciens, interno in urceolum breviter erectum ore lato expansum; *stylus* tenuiter subulatus, stamina subæquans. *Stigma* parvum, 4-lobum aut fimbriatum. *Ovarium* inferum, turbinatum, vertice intra discum concavum, 4-loculare; *ovula* in quoque loculo plurima, funiculis ad axem radiatim affixa. *Drupa* ovato-oblonga, utrinque obtusa, calyce coronata, extus leviter opace granulosa, abortu 3- 2- vel 1-locularis: *pericarpium* molliter coriaceum, subcrassum, lignose fibrosum; *semina* in loculis pauca vel plura, in *pulpa* pannosa nidulantia, *funi-*

culo brevi lato munita, ovata, compressa; *integumentum externum* tenuiter membranaceum (R. Br.), evanidum; *albumen*? (aut *integumentum internum*) album, crasse carnosum, subfirmum; *embryo* inclusus; *radicula* longiuscula, valida, teres, supra medium subito inflexa, et hinc inæqualiter bicrura, crure longiore raphæ proximo ad hilum spectante, crure altero parallelo breviore cotyledones 2 gestante; *cotyledones* brevissimæ, ovatæ, erectæ, applicitæ, incumbentes, tenuiter foliaceæ, marginibus integris (vel paucidenticulatis, *R. Br.*, aut plicatæ ,*Blume*).

Arbores in insulis Moluccensibus vel in Australia boreali vigentes, *frondosæ*; folia *alterna, oblonga vel orbiculata, crenato-serrata, glabra, petiolata*; inflorescentia *terminalis aut in ramulis novellis superioribus, brevissime ramosa, hinc pseudo-paniculata*; flores *speciosi.*

1. Planchonia crenata, nob.: *Eugenia crenata*, Soland. MS.: *Careya crenata*, R. Br. in MS. ined. no. 75, in Mus. Brit. (olim *Butonicoides crenata*, R. Br. *l. c.*): *Careya arborea*, var. *australis*, Benth. (non Roxb.) in Flor. Austr. iii. p. 288: arbor ramis expansis, iterum ramulosis, ramulis 3 ultimis floriferis, brevibus, crassiusculis, pallide brunneis: foliis late ovalibus, apice in acumen sæpe lineare mucroniforme subito constrictis, imo in petiolum longiusculum breviter acutatis, margine crenulato-serrulatis, supra pallide viridibus, nervis tenuibus vix immersis, subtus paullo pallidioribus, costa carinata albicante, nervis prominulis; petiolo tenui, acute marginato, limbo 4plo breviore: racemis subaxillaribus, solitariis, aut in ramulis novellis terminalibus, paucifloris; rachi valida, longiuscule nodosa; pedicellis brevissimis, ad nodos articulatis, 1-floris, flore hinc sæpe caduco; calycis limbo imo brevissime cupulato, cum sepalis 4 rotundate ovatis vel oblongis, coriaceis, fuscis, marginibus membranaceis subciliatis; petalis 4, oblongis, unguibus tubo staminigero agglutinatis; staminibus numerosissimis imo in tubum brevem monadelphis; disco margine externo staminifero, interno in tubulum brevissimum membranaceum undulatum expanso; stylo filiformi, valde incurvo; stigmate parvo, obtuse lobato; ovario infero, turbinato, vertice intra discum valde concavo, 4-loculari, ovulis plurimis biserialiter axi affixis: drupa elliptica, oblonga, lævi, viridi, sicca pallide brunnea, calyce styloque coronata; pericarpio crassiusculo, fibroso-coriaceo, 4-loculari, aut abortu loculo unico maturescente, polyspermo; seminibus compresse ovalibus, in pulpam pannosam immersis, integumento fusco membranaceo tectis; albumine? aut integumento interno? carnoso-coriaceo, primum viridi, demum albo; embryone ut in char. gen. In Australia: *v. s. in hb. Mus. Brit.* Cape Grafton (*Banks et Solander*), Carpentaria Bay (*R. Brown*); *in herb. Hook.* Port Darwin (*Schomb.* 347), Victoria River (*Mueller*): *v. fruct.* cum sp. R. Br. et Schomb.

These ample details, derived principally from Brown's notes and specimens, are fully confirmed by all the others which I have seen. Brown describes it as a large or middle-sized tree, with a thick trunk and a spreading comose head; the branchlets are marked by numerous cicatrices of the fallen leaves, which are $\frac{1}{2}$ in. apart; the leaves, thus somewhat crowded, are 4–$4\frac{1}{2}$ in. long, $2\frac{3}{4}$–3 in. broad, on a slender petiole 9–10 lines long, and have about 16 pairs of parallel nerves, 3 lines apart. In Schomburgk's specimen from Port Darwin, the inflorescence is axillary, short, with few flowers upon a rather slender rachis; the pedicels alternate, 2 lines long, articulated on a prominent node; the ovary,

3 lines long, is crowned by the tubular free portion of the calyx 1 line deep, surmounted by 4 erect, rounded, coriaceous sepals 3 lines long; the petals are 8 lines long, 3 lines broad. It is accompanied by a single loose fruit, 2 in. long, 11 lines broad, very ventricose on one side, straight on the other, owing to the abortion of 3 of its cells; the remaining cell contains 4 seeds 4 lines long, with the hilum pointing to the straight edge; the pericarp, filled with woody fibres, is 3 lines thick. Brown's specimen presents a very different aspect, owing to the thickening of the rachis, which supports a matured fruit and another only half matured, in which the petals and stamens still remain; the rachis is about 4 in. long, very stout, with long persistent nodes, which, as in *Couratari*, support each one flower articulated upon it; the pedicel, 1 line long, presents at its base a cuneated oblong bract 12 lines long, 4 lines broad. The half-grown fruit is oval, 12 lines long, 7 lines broad, supporting the calycine tube, 2 lines deep, with its 4 sepals, the petals and stamens still remaining. The ripe fruit is quite oval, $1\frac{3}{4}$ in. long, $1\frac{3}{8}$ in. broad, crowned by the free portion of the calyx and style; the contents of the 4-celled pericarp are nearly all destroyed by insects; the axis, decayed pulp, and many seeds, mostly damaged, are still manifest, confirming the description of Brown. A section of Schomburgk's 1-celled fruit is shown in Plate IX. fig. 8; it is less destroyed by insects, and contains 4 horizontal seeds of the same shape and size, embedded in pulp, now reduced to loose grains; the outer thin integument has disappeared; but the inner thick coating (now white) remains; and in all four, at the apex, along one edge, there is a linear open slit, which extends to the cavity over the summit of the enclosed embryo; the embryo fills the cavity, is of the horseshoe-shape described by Brown; and I have given in fig. 14 a magnified view of the same. Brown, in his description, says, "albumen nullum;" but he described the thick inner coating (which, it appears to me, must be albumen) as being carnoso-coriaceous green when fresh, afterwards becoming white: it seems too thick for a mere integument, shows no sign of a raphe or chalaza; and being of a greenish colour, it responds more to the condition of albumen. Solander's specimen has no inflorescence, ut has two loose flowers, which correspond with the others above referred to.

2. Planchonia sundaica, Miq. in Flor. Ned. Ind. p. 493 (excl. synom.); Walp. Ann. iv. 852: *Planchonia undulata*, Tenn. & Ben. in Cat. Hort. Bogor.: foliis elliptico-oblongis vel obovatis, apice acute acuminatis, imo cuneatis, marginibus cartilagineis, valde undulatis, subrevolutis, integris vel obsolete serrato-crenatis, rigide chartaceis, supra fusco-viridibus, sublucentibus, subrufescentibus, nervis plurimis tenuibus rufulis prominulis, costa tenui subimmersa, subtus pallidioribus, brunneis, costa rubra nervisque prominentibus, transversim reticulatis; petiolo valido, marginibus latiusculis recurvatis, limbo 16plo breviore: racemo terminali, brevi; rachi crassa, angulata, crebre multiflora; nodis floriferis apice bracteolatis; floribus ad nodos subsessilibus; sepalis 4, parvis, acute ovatis, subcoriaceis, griseo-pruinosis, imo in tubum brevem coalitis; petalis obovatis, 3plo longioribus, carnosulis; ovario infero, cylindrico, 8-costato, vertice disco plano margine interno acute elevato, intus circa stylum valde concavo, 4-loculari, ovulis in quoque loculo pluribus, axi radiatim affixis:

drupa ellipsoidea, lævi. In Java: *v. pl. s. in hb. Hook.* in hort. Bogor. cult. (*De Vriese*), eodem loco (*Benedyk*, sub *P. undulata*); *fruct. non vidi.*

The leaves have a reddish hue; they vary in size, 3–8½ in. long, 1¾–4 in. broad, on a decurrent petiole 2–4 lines long; they have about 20 pairs of closely parallel nerves. The ovary is 2 lines long, the sepals 3 lines long, the petals 9 lines long, 4 lines broad, the many-seried stamens somewhat longer.

3. Planchonia nitida, Bl. in Van Houtte, Fl. Serr. iv. p. 24 (excl. synon.): foliis elliptico-oblongis vel ellipticis, apice acutis, acuminatis aut obtusis, imo cuneatis, margine inæqualiter sinuato-serratis, chartaceis, supra nitidis; petiolo limbo 9–12plo breviore: inflorescentia ignota: drupa ellipsoidea, lævi. In insulis Sundaicis: *non vidi.*

This species must not be confounded with the *Barringtonia nitida*, Miq., which is a *Stravadium*. There is nothing in the above laconic description to show that it belongs to *Planchonia*. Its identity with Blume's original *Gustavia valida* cannot be admitted, as the more accurate Hasskarl has given so excellent a character of the latter plant. It must therefore be considered a very doubtful species of *Planchonia*. Blume says that its leaves are 3–8½ in. long, 1¾–4 in. broad, on petioles 3–8 lines long.

4. Planchonia tetraptera, nob: *Gustavia alata*, Spanag. in Linn. xv. 204: *Myrtus alata*, Zeppell, *l. c.* 204: *Barringtonia acutangula*, Spanag. *l. c.* 204: *Planchonia timoriensis*, var. *alata*, Miq. in Fl. Ind. Ned. i. p. 493: *Planchonia timorensis*, Bl. in Van Houtte, Fl. Serr. vii. p. 25: ramulis junioribus alato-angulatis; foliis majusculis lanceolato-oblongis vel oblongo-ellipticis, apice in acumen breve obtusum apiculatis, imo cuneatis et in petiolo late decurrentibus, margine irregulariter crenatis, dentibus lateraliter mucronulatis; petiolo alato, marginibus in ramulo decurrentibus, limbo 8–12plo longiore: inflorescentia ignota: drupa ovoidea vel ellipsoidea, lævi. In ins. Timor: *non vidi.*

It is better to change the specific name *alata*, that the species may not be confounded with *Barringtonia alata*, Wallich. Blume referred this species to his *Planchonia timoriensis*, which he considered to be the same as the *Gustavia alata* of Spanaghoe, from Timor, with which the *Myrtus alata* of Zippel was regarded as identical: we recognize the same species in Miquel's var. *alata* of Blume's *Planchonia timorensis*. The species is distinguished by the broadly winged angles of its branches. The leaves, according to Blume, are 3¾–8 in. long, 2–3½ in. broad, on petioles 6–12 lines long, some of the leaves growing to a length of 17 in. according to Miquel. Miquel's variety *bimensis* may probably be a distinct species.

5. Planchonia elliptica, nob.: ramulis brunneis, opacis, striolatis: foliis ellipticis, apice obtusis et in acumen breve subito constrictis, imo cuneatis, marginibus cartilagineis inæqualiter crenulatis, rigide chartaceis, sæpe conduplicatis, supra (in siccitate) fuscis, rubescenti-brunneis, lucidis, nervis parallele divaricatis tenuibus costaque tenui prominulis, subtus pallide brunneis, nervis venisque transverse reticulatis

prominulis; petiolo fusco, revolutim marginato, limbo 8–9plo breviore: racemis in ramulis foliiferis, terminalibus, folio subbrevioribus; rachi erecta, crassiuscula, nodosa, nodis validis apice 1-floris (bracteatis ?); floribus sessilibus; calyce cupulato 4-lobo, lobis semiovatis crasse coriaceis, intus pruinosis, extus granosis, fuscis; petalis 4, sepalis 4plo longioribus, oblongis, parallele nervosis, pruinosis, pallide roseis, unguibus tubo stamineo brevissime agglutinatis; staminibus numerosissimis, multiseriatis, petalis subæquilongis, imo in tubum longiusculum erectum monadelphis, nonnullis antheriferis, reliquis sterilibus; filamentis granulatim corrugulosis; stylo longo, tenui; stigmate breviter fimbriato; ovario infero, turbinato, subtetragono, corrugato, pruinoso, 4-loculari; disco epigyno plane annulari, margine exteriore tubum staminigerum gerente, intus fornicatim prominente, verticem concavum ambiente. In Borneo: *v. s. in hb. Hook.* Banjarmassing (*Motley* 750).

The raceme-bearing branchlets 2 in. long, with 2–4 leaves crowded toward the apex; leaves 3–4½ in. long, 1⅝–2⅜ in. broad, on petioles 4–7 lines long, and with about 12 pairs of parallel nerves 3 lines apart; terminal raceme 2 in. long, furnished with many crowded very beautiful flowers, sessile on the nodose expansions of the rachis, which are 1 line long and thick, and 1–2 lines apart; ovary 2 lines long, its crowning sepals 3 lines long; petals 13 lines long, 4½ lines broad; monadelphous tube of stamens 3 lines long, and 3 lines in diameter; stamens numerous, many of them sterile; ovary subtetragonous, 4-celled, with numerous ovules in each cell attached to the axis: their characters are quite those of *Planchonia*, to which this species is referred. Its fruit is unknown.

6. Planchonia littoralis, Bl. in Van Houtte, Fl. Serr. vii. p. 25: *Perigara valida*, Bl. (in parte) Bijdr. *l. c.* 1096: ramis rugulosis, striatis, junioribus pallide brunneis, opacis, vix striolatis: foliis ellipticis, vel elliptico-oblongis, apice in acumen subbreve subacutum angustissime obtusulum et subemarginatum constrictis, imo sensim et anguste cuneatis, margine subrevoluto cartilagineo inæqualiter sinuato serratis, dentibus erectis obtusis vel sæpius acute mucronulatis, chartaceis, supra pallide viridibus, opacis, costa tenuissima nervisque pallidis prominulis, venis valde reticulatis, subtus pallidioribus, costa striolata nervisque albescentibus paullo prominentibus; petiolo tenui, limbo 15plo breviore: inflorescentia ignota: drupa elongato-ellipsoidea, costatim subangulata. Java in maritimis: *v. s. in hb. Hook.* in hort. Bogor. cult. (*Anderson*, sub *G. valida*, sine flore aut fructu).

A species differing from *P. sundaica* in its broader, less acuminated, paler leaves, upon longer petioles. It is cultivated in the Bogor Gardens, probably introduced from one of the Sunda Islands. Its leaves, ¼–½ in. apart, are 4½–7½ in. long, 1¼–4 in. broad, on petioles 3–6 lines long. Blume considered it the same as his *Perigara valida*, because it is so named in the Bogor Gardens; but that is a very different species.

7. Planchonia valida, nob.: *Pirigara valida*, Bl. Bijd. 1096: *Gustavia valida*, DC. Prodr. iii. 290; Hassk. Bot. Zeit. (1844) xxvii. p. 595: procera: foliis ovali- vel late ellipticis, apice acute vel subretuse acuminatis, imo cuneatis vel retusis et in peti-

olo decurrentibus, margine denticulatis; petiolo lato, limbo 12–14plo breviore, marginato: inflorescentia ignota; sepalis 4 semiorbicularibus, ovario æquilongis, erectis; petalis 4plo longioribus, obtuse oblongis, viridiusculis, flaccidis, reflexis; staminibus quam hæc longioribus, pluriseriatis, filiformibus, imo in tubum sepalis longiorem monadelphis, imo sanguineis, apice albescentibus; disco epigyno plane annulari, extus tubum staminigerum gerente, margine interno in urceolum erectum expanso, vertice hinc profunde cavo; stylo longe filiformi, flexuoso, viridi; stigmate obtuso; ovario subturbinato, obsolete octagono, 3–4-loculari, ovulis in quoque loculo plurimis biseriatis. In Java et ins. Nusa Kambanga in sylvis: *non vidi.*

The excellent description of Hasskarl shows that this species belongs to *Planchonia*, which is confirmed by the seminal structure indicated by Blume eighteen years previously. Blume, however, confounded it with his *Planchonia nitida*, from which it is evidently distinct. It is described as a tall tree growing in woods; its leaves are 3–7 in. long, $2\frac{1}{2}$–$3\frac{3}{4}$ in. broad, on petioles 3–6 lines long, 3 lines broad; the ovary is 3 lines long; the sepals of the same length; the petals are 14 lines long, 6 lines broad; the staminiferous tube is 6 lines long, the filaments 18 lines long; the style is 24 lines long.

6. Careya.

A genus established in 1819 by Roxburgh in his 'Plants of Coromandel,' and acknowledged by all botanists: it consists of four species, natives of India and the Malayan peninsula, where they form trees of considerable size, with one exception, which is of low suffruticose stature. The inflorescence is extremely short, terminal on the nascent branchlets, with a thick fleshy rachis, bearing 1–4 very approximated sessile handsome flowers, each supported by 2 bracts, often of large size: the adnate calyx is surmounted by a cup-shaped limb, divided halfway into 4 rounded segments, which are subimbricated in the bud; 4 large obovate fleshy petals; the stamens, of unequal length, are very numerous, pluriserial and monadelphous at their base, and present the peculiarity that the outer and longer series, as well as the inner and shorter rows, are destitute of anthers, the intermediate series alone being antheriferous; the inferior ovary is usually 4-, rarely 5-celled, with several ovules in each cell, radiating from the central axis. The fruit is globose, about the size of an orange, is crowned by the persistent calycine limb, has a smooth coriaceous pericarp, normally 4-celled; but the dissepiments usually disappear, absorbed in the rather solid pulp, in which the many seeds are imbedded: the seeds are oblong, subcompressed, about the size of a field-bean, sometimes smaller; they have no albumen, have an external thick testa, covering a solid mesopodal embryo, which often begins to germinate in the ripe fruit. This embryo, as in other genera, though solid, is actually formed of two agglutinated layers, the outer of which (the exorhiza) was declared by Roxburgh and Wight to be the albumen, the inner (neorhiza) being regarded by them as an embryo with agglutinated indistinguishable cotyledons and radicle. Roxburgh, in a drawing copied by Wight, showed this seed in the act of germination; but this was afterwards better illustrated and explained by Dr. Thomson in the germinating seed of *Careya arborea*, where he showed there was no albumen, and that the inner body alone

(the neorhiza), by the protrusion of both extremities, produced at one end the growing leafy stem, at the other end the root of the new plant. Other observations of Dr. Thomson are of extreme importance, as explaining the progress of this growth. No doubt can now be entertained on this subject. Griffith gave several figures to illustrate the growth of a similar seed in a plant named by him *Careya pendula*, but which I have shown to belong to the genus *Doxomma*. The Australian species considered a variety of *Careya arborea* is *Planchonia crenata*.

Careya, Roxb.

Calycis adnati *limbus* breviter cupuliformis, fere ad basin in sepala 4 rotundata divisus, hæc in æstivatione subimbricata, in fructu persistentia. *Petala* 4, calyce multo longiora, cuneato-oblonga, expansa, unguibus tubo staminigero affixis et cum illo caducis. *Stamina* numerosissima, pluriseriata, petalis longiora, imo in tubum brevem erectum monadelpha: *filamenta* filiformia, inæquilonga, seriebus exterioribus longioribus, interioribusque brevioribus anantheris, intermediis solummodo fertilibus; *antheræ* parvæ, subbilobæ. *Stylus* tenuiter subulatus, staminibus æquilongus incurvus. *Stigma* obsolete 4-lobum. *Discus* pulvinatim annularis, margine externo tubum staminigerum fulciens, interno in urceolum erectum expansus. *Ovarium* inferum, turbinatum, 4-loculare, vertice intra discum concavo; *ovula* in quoque loculo plurima, axi affixa. *Fructus* globosus, calyce persistente coronatus: *pericarpium* crasso-coriaceum, 4-loculare, dissepimentis mox evanidis; *semina* plurima, vaga, compresse ovata aut oblonga, in *pulpam* pannosam fibrillis interspersam immersa; *testa* lævis, pallide brunnea; chartacea, *embryo* exalbuminosus, elongato-oblongus, mesopodus, sæpe intra pericarpium germinans.

Arbores *frondosæ in India et Malacca indigenæ, rarius suffruticosæ*: folia *sæpe majuscula, oblonga vel orbiculata, serrata, petiolata*: racemi *terminales aut laterales subspicati*; flores *speciosi, sessiles, imo sæpius 2-bracteati.*

1. Careya herbacea, Roxb. Pl. Corom. iii. 13, tab. 217; Fl. Ind. ii. 638; DC. iii. 295; W. & A. Prodr. Fl. Pen. i. 335; Wight, Icon. t. 557; Griffith, Proc. Linn. Soc. i. 280; Notul. pars iv. (excl. descr. pl. p. 660), tab. 634, cuj. figuræ 6 sistent (reliq. excl.); Miq. Flor. Ned. Ind. i. 494. In Ind. Or.: *v. s. in hb. Mus. Brit.* Nepal (*Buchanan*).

A small half-herbaceous shrub, growing in the interior of Bengal and extending into Nepal. It has a ligneous perennial root, which throws out several short perishable branches. Its leaves are 4–8 in. long, $1\frac{1}{4}$–$2\frac{1}{2}$ in. broad, cuneately obovate, acute at the apex, serrulate, smooth on both sides, on a petiole 4 lines long. It has short axillary racemes, bearing a few beautiful flowers, almost sessile, within 2 lanceolate bracts, which embrace the calyx; the calycine limb is 7 lines long, cup-shaped at the base, and divided halfway into 4 roundish lobes, which are distinct in the bud; the oblong pink petals are $1\frac{1}{8}$ in. long, $\frac{5}{8}$ in. broad; filaments closely many-seried, all agglutinated to the monadelphous tube, and falling off with the petals attached to its base, the exterior series bearing no anthers; ovary 4-celled, with 3 or 4 ovules in each cell. Fruit globular, less than an inch in diameter, crowned by the persistent calyx, without any visible dissepiments, and filled with a greenish pulp, in which the seeds are enveloped; the seeds are oblong, compressed, 3 lines long, with a homogenous embryo, which often germinates within the fruit.

The description of Griffith, under the head of *C. herbacea*, by a mistake of the Editor, belongs to some *Anacardiaceous* plant. See my remarks under *Doxomma pendulum* (page 100).

2. Careya arborea, Roxb. Pl. Corom. iii. p. 14, tab. 218; Fl. Ind. iii. p. 638; Ham. Trans. Linn. Soc. xv. p. 97; Rheede, Hort. Malab. iii. p. 35, tab. 36; DC. Prodr. iii. 295; W. & A. Prodr. i. 334; Wight, Illustr. p. 20, tab. 99, 100; Miq. Fl. Ned. Ind. i. 494: *Careya sphærica*, Wight, in parte (non Roxb.), Icon. tab. 556. In Ind. Orient.: *v. pl. s. in herb. Mus. Brit.* E. Ind. (*König*), ibidem (*Buchanan*); *in herb. Hook.* E. Ind. (*Carey*), Sikkim (*Hook. et Th.*), Afghanistan ad Kala Nudde (*Ritchie* 362).

A tree, sometimes of immense size, inhabiting the valleys in Orissa and other provinces of India, with many spreading branches sulcately angular, often covered with the cicatrices of fallen leaves. The broadly ovate leaves are suddenly constricted at the apex by a sharp point, are cuneate below the middle, the margins with small close teeth, subflaccid, pale green and opaque above, with about 16 pairs of slender prominulent nerves and a flat midrib, paler beneath, with straw-coloured prominent nerves; they are 7–8 in. long, $3\frac{3}{4}$–$4\frac{1}{4}$ in. broad, on a channelled margined petiole 2–3 lines long. The raceme is terminal, 6–8 in. long, bearing about 3 flowers at the extremity of its stout rachis, which are almost sessile, with 3 bracts at their base; the calyx is tubular, 10 lines long, 5 lines broad, its margin being divided into 4 valvate acute lobes or sepals 3 lines long; the petals are 12–15 lines long, 5 lines broad, with their margins laterally turned back; the stamens are of various lengths, in many series, the longer and shorter series barren, the intermediate series antheriferous; they are all agglutinated at their base into an erect tube, seated on the outer margin of the disk, and to which the claws of the petals are also affixed. The globular drupe is 2 in. in diam., with a smooth fleshy fibrous pericarp 1 line thick; seeds ovate or oblong, compressed, scattered through a rather solid pulp. The fetid wood is useful, of a reddish colour, with a grain not so close nor so hard as mahogany; and strong ropes are made from the fibres of its bark.

3. Careya sphærica, Roxb. Fl. Ind. iii. 336; Wight, Icon. (ex Roxb.), tab. 147 (non 556); Miq. Fl. Ned. Ind. i. 494. In Malacca, Khasya, et Sikkim: *v. s. in herb. Hook.* Chittagong (*Wall. Cat.* 3640), Kumaon (*Strachey*), Sikkim (*Hook. et Th.*), Mergui (*Griffith*).

A tree 30 feet high, with a trunk 12 feet long, 8 in. in diam., growing beyond the limits of the Indian peninsula. It yields a bark with strong fibres. It differs from *C. arborea* in its larger, broader, more rounded leaves, in its much longer racemes with a thicker rachis, in its more numerous, crowded, larger sessile flowers, bibracteolated at their base. Its branches have a smooth ashy bark, with leaves approximated on their summits. Leaves oblong-ovate, broad, rounded towards the apex, with a short abrupt acumen, suddenly and broadly cuneated towards the base, the margins being minutely crenulate-dentate; they are subcoriaceous, lucid above, with about 20 pairs of patently divaricated nerves conjoined near the margin; they are 9–12 in. long, $4\frac{1}{2}$–$6\frac{3}{4}$ in. broad, on a petiole 4–6 lines long. The racemes are terminal, several inches long, bearing near their summit 6–12 approximated sessile flowers, each supported by 3 basal rounded bractlets 3 lines long and broad; the ovary, 5 lines long, is surmounted by 4 nearly

erect rounded sepals; the 4 petals subacutely oblong, $1\frac{1}{2}$ in. long, 4 lines broad, have the margins rolled back, and are of a palish green colour; ovary 4-celled, with numerous ovules in each cell. Drupe globular, nearly 2 in. in diam., crowned by the calycine lobes; the pericarp and pulp, of a yellowish colour, contain few seeds compressed oblong, about 5 lines long, constructed like those of *C. arborea*. The specific name is not derived from the shape of its leaves, but from the spherical head of large flowers approximated at the extremity of the rachis. Miquel suggests that the species, so well described and figured by Roxburgh, should be expelled from the genus; but as he never saw the plant, and offers no reason for his suggestion, it cannot be admitted. The analysis of this species is shown in Plate XVI. fig. 9 *et seq.*

4. Careya orbiculata, nob.: ramulis lævibus aut rugulosis, cortice crasso: foliis orbiculatis apice rotundatis et obsolete emarginatis, imo subito breviter cuneatim constrictis, ad marginem planum inæqualiter grosse crenatis, dentibus brevissimis obtusis, chartaceis, supra ex brunnescente viridibus, sublucentibus, nervis paucis divergentibus tenuibus paullo prominulis, subtus brunneis, opacis, nervis flavidis venisque reticulatis prominentibus; petiolo plano, compresso, marginato, limbo 20plo breviore: racemo terminali, brevissimo, rachi angulato-sulcata pauciflora; floribus approximatis, sessilibus; calycis limbo cupuliformi fere ad basin in sepala 4 rotundata carnosa diviso, extus pruinoso vel rufo-tomentello; petalis 4, obovato-oblongis, calycis 5pla longitudine, medio crassiusculis, marginibus late submembranaceis, extus flavide pruinosis; staminibus pluriseriatis imo in tubum disco insitum monadelphis, filamentis granulato-rugulosis; disco annulari, plano, margine externo tubum staminiferum gerente, intus in prominentiam tenuem erectam verticem ambientem expanso; ovario infero, tetragono, profunde transverse corrugulato et fere tuberculoso, 4-loculari, ovulis numerosis in axe undique collateraliter affixis. In regno Burmensi et penins. Malayensi: *v. s. in hb. Hook.* Mergui (*Griffith*), Ind., Or. (*Carey*); *fruct. non vidi.*

The stout branchlets of this species are $\frac{1}{4}$ in. thick, closely studded with small cicatrices of fallen leaves; the leaves are 5–$5\frac{1}{4}$ in. long, $4\frac{1}{4}$–$4\frac{1}{2}$ in. broad, on petioles 3–4 lines long: the fragment of the rachis of the terminal raceme is only $\frac{1}{2}$ in. long, marked by the nodes where 4 flowers were affixed; the flowers are loose; the rugous 4-angular ovary 4–5 lines long; the superior limb of the calyx is divided into 4 rounded sepals 4 lines long and broad; the petals 15 lines long, 8 lines broad; the filaments, of equal length, are granulated and conjoined at their base into a tube, to which the petals are also attached by their claws. This species is shown in Plate XVI. fig. 6.

7. Doxomma

is a new genus[1], distinguished from all the preceding by well-marked characters. Its species are lofty trees, with rather large, oblong, cuneated leaves, often upon unusually long petioles. The inflorescence is a very long spike of large handsome flowers, often much approximated and sessile, sometimes bracteolated, upon a stout fleshy rachis

[1] So named from δόξα (*gloria*), ὄμμα (*adspectus*), because of its splendid flowers.

which is erect or more frequently drooping from its great weight; the calycine limb is shortly cup-shaped, and divided nearly to its base into 4 rounded ciliated sepals, imbricated in the bud; the disk as in the other genera; the stamens are monadelphous, upon an erect tubular ring, which is seated on the outer margin of the disk; the filaments, long and slender, coiled in æstivation, afterwards spreading in many series, are all fertile, with small yellow 2-celled anthers; the petals are large and oblong; the style, as long as the stamens, is subulate, terete, with a minute clavate stigma; the inferior turbinate ovary, often 4-winged, is 4-locular, with 2 ovules in each cell, suspended from the summit by thickish funicles. The fruit is cylindrically oblong, furnished with 4 equal longitudinal undulating wings; the pericarp is coriaceous and fibrous, by abortion 1-celled, with a single suspended seed, which fills its cavity; this is covered by a thin coriaceous testa, somewhat adhering to the pericarp; the enclosed embryo is white, nearly as hard as ivory, homogeneous, consisting of two layers, separable by a stratum of tissue (the medullary sheath) which in drying becomes black and pruinose; the outer layer or exorhiza splits at each end longitudinally for some length into four equal divisions, thus leaving both ends of the enclosed inner layer (the neorhiza) somewhat exposed. The embryo, as thus described, is shown in Plate VII. figs. 3, 4, 5, taken from Loureiro's own specimen, now preserved in the British Museum, of his *Eugenia acutangula* (non Linn.). Its structure is evidently analogous to that of the embryo in *Agasta*, *Butonica*, *Stravadium*, and *Careya*, only more pronounced and better corresponding with Gaertner's plate 101 and with Dr. Thomson's instructive observations. To this genus I have referred the *Careya macrostachya* of Jack, and the *Careya pendula* of Griffith.

Doxomma, nob.

Calycis adnati *limbus* breviter cupuliformis, margine in sepala divisus; *sepala* 4, æqualia, rotundata, subcoriacea, ætivatione subimbricata, persistentia. *Petala* 4, oblonga, calyce longiora, crassiuscula, marginibus membranaceis retroflexis, unguibus tubo staminigero agglutinatis et cum illo caduca. *Stamina* numerosissima, multiseriata, imo in tubum subbrevem cylindricum monadelpha, seriebus interioribus sæpe brevioribus, setiformibus, et anantheris. *Stylus* illis æquilongus, tenuiter subulatus, paullo curvatus. *Stigma* simplex. *Discus* plane annularis, margine exteriore tubum staminigerum sustinens, intus in prominentiam erectam ore lato expansus. *Ovarium* inferum, turbinatum, tetragonum, 4-loculare, vertice intra discum concavum; *ovula* in quoque loculo 2, ab apice funiculis suspensa. *Fructus* cylindrice oblongus, subtetragonus, angulis costatis aut anguste alatis, unilocularis, monospermus; *pericarpium* subcrassum, fibroso-coriaceum, calyce coronatum: *Semen* loculum implens, funiculo suspensum; *testa* tenuiter coriacea, pericarpio subadhærens: *embryo* conformis, homoneus, dure eburneus, mesopodus, *exorhiza* a neorhiza soluta, ad utramque extremitatem 4-fissa et hiante, intus pulvere nigro tecta, *neorhiza* in germinatione, ut in *Butonica*, utrinque propullante.

§ 1. *Petioli elongati.*

1. **Doxomma pendulum**, nob.: *Careya pendula*, Griffith, Notulæ, pars iv. p. 661, tab. 634 A. fig. 1 ad 10 select.: arbuscula, ramulis subtenuibus, lævibus, rubidulis: foliis in apice ramulorum confertis, longe lanceolatis, utrinque valde acutis, marginibus cartilagineis subrevolutis obsoletissime serratis, chartaceis, supra pallide viridibus, opacis, nervis tenuibus patentim divaricatis marginem versus nexis

prominulis valde reticulatis, subtus paullo pallidioribus, costa striata valde prominente, nervis stramineis prominentibus; petiolo tereti, imo crassiore, limbo 8plo breviore: racemo terminali, multifloro, nutante; rachi valida, imo crassiore, angulato-sulcata, colorata; floribus majusculis, subapproximatis, subsessilibus vel brevissime pedicellatis, bracteolis minutis subulatis imo donatis; calyce cupulari, fere ad basin in lobos 4 subimbricatos rotundatos coriaceos marginibus membranaceis ciliato-denticulatis diviso; petalis 4, expansis, crassiusculis, profunde rubris, elongato-ovatis, calycis 3pla longitudine, marginibus revolutis, unguibus ad tubum staminigerum affixis et cum illo caducis; staminibus numerosissimis, albis, quam petala longioribus, pluriseriatis, interioribus sterilibus; disco annulato, margine exteriore tubum staminiferum erectum fulciente, intus in urceolum verticem ovarii concavum cingentem producto; ovario subcylindrico, tetragono, ovulis 3 in quoque loculo funiculis brevibus suspensis: fructu (vix maturo) cylindrice oblongo, apice subconstricto et calyce coronato, subtetragono, lævi, rubidulo, pericarpio crasso, abortu 1-loculari et monospermo; semine ovato, cum ovulis abortivis pendulo, raphe lineari cum funiculo crassiusculo continua, testa reticulata, imo chalaza signato. In regione Malayana et Borneo: *v. s. in hb. Hook.* Mergui (*Griffith*), Mergui (*Parish* cum icone), Sarawak (*Beccari* 3255).

A low tree, growing in woods on hill-sides. A good floral analysis is given both by Griffith and Parish. The branchlets are $\frac{5}{8}$ in. thick; the leaves are 11–14 in. long, $2\frac{1}{2}$–3 in. broad, on petioles $1\frac{1}{4}$–$1\frac{3}{4}$ in. long, with about 15 pairs of nerves, and others shorter and intermediate. The raceme is $2\frac{1}{2}$ feet long, with a stout sulcated rachis 3–5 lines thick; flowers $\frac{1}{4}$–$\frac{1}{2}$ in. apart; calycine lobes $\frac{1}{2}$ in. long and broad; petals $1\frac{1}{2}$ in. long, $\frac{1}{2}$ in. broad; stamens 2 in. long; fruit $2\frac{3}{4}$ in. long, 11 lines broad; seed $\frac{3}{4}$ in. long, $\frac{1}{2}$ in. broad. Griffith, in p. 662, refers to a drawing of this in his tab. 634 A; but there we find a jumble of figures, without numbers, belonging to *Careya* and *Cornus*, 15 figures belonging to the former, the remainder to the latter genus. Of the former I take ten to represent the seed of this species, the two top figures on the left hand showing them in their natural size as above described; another figure shows it magnified to double that size; and seven others exhibit the same, with the embryo before and after it commences germination, showing at the plumular end a curving subulate shoot, furnished at its base with imbricating scales. The five larger figures before mentioned seem to belong to his *Barringtonia conoidea*, for which there was no room in his Plate 615. This intermixture of figures without explanation is attributable to the editor of Griffith's 'Notulæ.' A drawing of this species (with its analyses) is shown in Plate XV. fig. 9 *et seq.*

2. Doxomma cylindrostachya, nob.: *Barringtonia cylindrostachya*, Griffith, Notulæ, part iv. p. 655: ramulis crassis, striatis, opacis: foliis subsparsis, longissime petiolatis, lanceolatis vel lanceolato-oblongis, apice breviter acuminatis, imo cuneatis, margine cartilagineo subrevoluto obsoletissime serratis, chartaceis, supra pallide viridibus, opacis, ad nervos sulcatis, nervis plurimis patenti-divaricatis, intra marginem nexis, transversim reticulatis, subtus flavidioribus, opacis, nervis valde prominentibus, costa prominente; petiolo tereti, striolato, pallide brunneo, imo

valde incrassato, limbo 4plo breviore: racemo terminali, folio subæquilongo; rachi crassa, cylindrica, densiflora, e floribus caducis creberrime cicatricata; floribus sessilibus; calyce pocilliformi crassiusculo, extus brevissime puberulo, fere ad basin in lobos 4 rotundatos diviso; petalis 4, obovatis, crassiusculis, calyce triplo longioribus; staminibus pluriseriatis, imo in tubulum longiusculum monadelphis; disco annulato, margine externo tubum staminigerum fulciente, intus in prominentiam erectam crenulatam verticem concavum cingentem producto; ovario turbinato, acute tetragono, angulis costatis, subcorrugulato, 4-loculari, ovulis in quoque loculo 4–5, axi affixis. In Birma: *v. s. in hb. Hook.* prope Avam (*Griffith* 2421), Malaya (*Maingay* 763).

This differs from the preceding species in its much longer petioles, and racemes with more crowded flowers: the axils of the leaves are $\frac{1}{2}$–$\frac{3}{4}$ in. apart; the leaves are $7\frac{3}{4}$–14 in. long, $2\frac{3}{4}$–$3\frac{1}{2}$ in. broad, on a petiole $1\frac{1}{2}$–$2\frac{1}{2}$ in. long, and with about 30 pairs of nerves; the raceme is 1 foot long, or longer; the rachis 3 lines thick, dark lilac, closely beset with smallish cicatrices of the fallen flowers; the ovary is 4 lines long; the calyx 3 lines, the petals 9 lines long, 4 lines broad; the stamens about 2 inches long; the style 3 in. long, of a deep red colour: 4 or 5 ovules in each cell, upper ones ascending, the lower subpendulous.

3. Doxomma cochinchinense, nob.: *Eugenia acutangula*, Lour. (non Linn.) Coch. i. 375 (excl. synon.): *Stravadium cochinchinense*, Bl. in V. Houtte, Flor. Serr. vii. p. 24: arbor, ramulis patentibus, fistulosis, brunneis, angulato-sulcatis, apice confertim foliiferis: foliis lanceolato-oblongis, apice in acumen angustum obtusulum constrictis, imo acute cuneatis, ad margines cartilagineos revolutos repandos obsolete serratis, subcoriaceis, supra pallidissime viridibus, nervis patentim divaricatis juxta marginem nexis prominulis, valde reticulatis, subtus ochraceo-flavescentibus, valde opacis, nervis venisque prominentibus; petiolo longissimo, limbi fere longitudine, tereti, pallide opaco: racemo (sec. cl. Lour.) longissimo, pendulo, simplici; sepalis 4, rotundatis; petalis 4, subparvis, subrotundis, concavis, conniventibus; ovario infero, rotunde turbinato: fructu cylindrice oblongo, utrinque subacuto, calyce coronato, tetragono, angulis acutis; pericarpio corticoso, subrugoso, flavide fusco; semine unico, magno, oblongo (farinulento dum vivo?), demum durissimo. In Cochinchina, in sylvis: *v. pl. s. in hb. Mus. Brit.* loc. cit. (*Loureiro*, specim. typ.); *v. fruct. in Mus. Brit.* (*Loureiro*).

From the typical specimen and fruit, this species may now be distinguished from the many heterogeneous plants erroneously referred to it. Although Loureiro recorded it as the *Eugenia acutangula* of Linnæus, he was aware of its nearer affinity to the *Butonica rubra* of Rumphius. He described it as a large tree with spreading branches. Its leaves are 4–10 in. long, 2–$2\frac{3}{4}$ in. broad, on petioles 3–7 in. long; they have about 14 pairs of patent fine nerves; the terminal raceme is often 2 feet long. The size of the flowers is not given; but the petals are stated to be small. The typical specimen of the fruit is 3 in. long, $1\frac{1}{4}$ in. broad, on a short stout pedicel; it is narrowed at each extremity, 4 lines broad at the throat, where it is crowned by the calycine limb 3 lines long. Its shape is somewhat fusiform and striolated, with 4 longitudinal wings, $1\frac{1}{4}$ line broad, and

wavy on the margin; the pericarp is fibrous, 1 line thick, and contains a single suspended seed, which fills the cell, and which has been fully described in the generic diagnosis (*ante* p. 99). A drawing of the leaf and of the carpical structure of this species is shown in Tab. XVI.

4. Doxomma acuminatum, nob.: *Stravadium acuminatum*, Bl. in Van Houtte, Flor. Serr. vii. p. 24; Wall. Cat. 3636: *Barringtonia* (*Careya*) *rosea*, Wall. Cat. 3636: *Barringtonia acuminata*, Korth. in Kruidk. Ned. Ind. Archip. p. 206; Miq. Fl. Ned. Ind. i. 490: foliis lanceolatis vel oblongo-lanceolatis, apice in acumen breve attenuatis, imo sensim acutis, marginibus tenuiter cartilagineis, obsoletissime serratis, tenuiter chartaceis, supra pallide viridibus, opacis, nervis tenuissimis, divaricatis, reticulatis, subtus concoloribus aut paullo pallidioribus, nervis venisque prominulis, costa tenui, striolata; petiolo tenuissimo, semitereti, imo gibbose incrassato, limbo 6plo breviore: racemis spicatifloris; rachi cylindrica, valida, sub medium e floribus caducis crebre cicatricata; floribus subparvis, subapproximatis, sessilibus; calycis limbo cupuliformi, coriaceo, ad basin in sepala 4 diviso, sepalis ferrugineo-pruinosis; petalis 4, roseis, calyce paullo longioribus; staminibus numerosissimis, imo in tubum monadelphis; disco annulari, margine externo tubum staminiferum fulciente, intus in prominentiam fornicatam verticem concavum ambiente producto; ovario quadratim turbinato, ferrugineo-pruinoso, angulis cum lobis calycinis alternis, alatis, subcrenatis, 4-loculari, ovulis 3–4 in quoque loculo suspensis: fructu elongato-ellipsoideo, utrinque obtuso, lævi, subtetragono. In Malacca et Borneo: *v. s. in hb. Soc. Linn.* Chappadong in ripis (*Wall. Cat.* 3636); *fruct. non vidi.*

Wallich's specimen from the province of Martaban agrees with Blume's diagnosis of a plant first mentioned, by name only, by Korthals, and to which he assigned the locality of Borneo. Wallich at first gave it the name of *Barringtonia* (*Careya*) *rosea*, but afterwards changed it to *Barringtonia acuminata*, considering it to be the same as Korthals's, perhaps; and if so, its range must be considerable. In Wallich's specimens the leaves are $5\frac{1}{2}$–8 in. long, $1\frac{1}{2}$–$2\frac{1}{4}$ in. broad, on petioles 1–2 in. long; Blume gives the dimensions as $3\frac{1}{2}$–11 in. long, $1\frac{2}{3}$–$3\frac{1}{2}$ in. broad, on petioles $\frac{3}{4}$–$2\frac{1}{2}$ in. long, from a plant collected by Korthals in the woods of Pamattan, in Borneo. The raceme in Wallich's specimen is above 9 in. long, 3 lines thick, straight; the sepals are 2 lines long, 3 lines broad; the 4 angles of the ovary are winged and undulately crenated; the inner margin of the disk is acute and elevated, within which the vertex is deeply concave.

5. Doxomma Sarcostachys, nob.: *Stravadium Sarcostachys*, Blume, in Van Houtte, Fl. Serr. vii. p. 24: *Barringtonia sarcostachys*, Miq. in Fl. Ned. Ind. 90: foliis lanceolato-oblongis, apice obtusis vel acutis, imo cuneatis, integerrimis, nervosis; petiolo tereti, limbo 4plo breviore: racemo spicato, rachi cylindrica, crassa, carnosa, recta: fructu subtetragono. In ins. Sumatra: *non vidi.*

Blume's short diagnosis is copied by Miquel, who adds, this species is very different from *D. sumatrana*. Both state that the leaves are $4\frac{1}{2}$–10 in. long, $2\frac{3}{4}$–$3\frac{1}{2}$ in. broad, on petioles 1–$2\frac{3}{4}$ or sometimes 3 in. long.

6. Doxomma sumatrana, nob.: *Barringtonia sumatrana*, Miq. in Fl. Ned. Ind. i. Suppl. p. 315: foliis elliptico-oblongis, apice in acumen obtusulum vel acutum subito constrictis, imo cuneatis, subcoriaceis, crenato-serrulatis, dentibus obtusis, sæpe mucroniformibus, supra lucidis, costa nervisque subpatulis prominulis, subtus nervis parum prominulis; petiolo longiusculo, supra subplano, marginibus acutis: racemo cylindraceo, terminali, erecto: fructu oblongo, acute tetragono, apice sepalis 4 obtuse ovatis coronato, lævi, pallido. In Sumatra: *v. s. in hb. Hook.* Sarawak (*Beccari* 851, 1554).

A species, according to Miquel, distinct from *D. Sarcostachys*, though closely allied to it; the leaves are said to be 3–8½ in. long, 1⅔–2⅔ in. broad, on petioles 2–2¾ in. long: no other particulars are given. I have referred here Beccari's specimen 851, from Sarawak, which agrees well with Miquel's character as to the leaves, but differs in its shorter petioles: here the leaves are elliptic-oblong, with a narrow acumen at its apex near ½ in. long; they are gradually subcuneate to the base, crenately serrulate on the margins, the teeth sometimes nearly obsolete and mucroniform, they are from 2½–10 in. long, 1⅛–2¼ in. broad, on semiterete petioles ¼–1⅛ in. long, with slender patent arcuated nerves; and the rachis is stout, more than 7 in. long (broken off at the summit); the sepals rounded, somewhat acute, smooth, fleshy, entire, 4 lines long and broad, united in a short cup at their base; the petals are obovate, rounded; the ovary is turbinate, rugulose, and sessile. In Beccari's 1554 the leaves are more lanceolate and paler.

7. Doxomma neo-caledonicum, nob.: *Barringtonia neocaledonica*, Vieill. in Proc. Soc. Linn. Normand. viii. p. 10: arbor excelsa, ramis erectis; ramulis subtenuibus, apice crebre foliiferis, inferne foliis delapsis cicatricatis: foliis lanceolato-oblongis, utrinque acutis, ad marginem subrevolutum cartilagineum obsoletissime serratis, supra læte viridibus, nervis tenuibus adscendenti-divaricatis prominulis, valde reticulatis, subtus flavide pallidioribus, glaucescenter opacis, nervis venisque prominentibus; petiolo subtenui, tereti, limbo 15-plo breviore: racemo terminali, pendulo, spicato, rachi cylindrica, crassiuscula, imo compressa, albide glauca, creberrime multiflora; floribus amplis, sessilibus, imo setaceo-bracteolatis; calyce cupuliformi, fere ad basin in sepala 4 ovata obtusa glabra subimbricata diviso, sepalis coriaceis, margine late submembranaceis, ciliato-denticulatis, extus albide scabridulis; petalis 4, oblongo-ovatis, crassis, albide roseis, sepalis 4plo longioribus; staminibus numerosissimis, pluriseriatis, imo in tubum brevem monadelphis, seriebus interioribus sæpe anantheris; disco plano, margine exteriore tubum staminigerum fulciente, intus in urceolum latum erectum producto, vertice hinc circa stylum concavo; ovario infero, obconico, ruguloso, alatim tetragono, alis rectis, angustis, 4-loculari, ovulis in quoque loculo 4, suspensis: fructu oblongo, cylindrico, calyce coronato. In Nova Caledonia, in sylvis humilioribus: *v. pl. s. in hb. Hook.* Gatasse, Wagap (*Vieillard* 2630); *fructum non vidi.*

A tall tree, 65–80 feet high, with leaves about ½ in. apart, 8–8½ in. long, 2⅜–2⅝ in. broad, on petioles 6–8 lines long: the raceme is more than 5 in. long, with a cylindrical straight rachis 3 lines thick, studded in many places with close cicatrices of the fallen flowers:

the handsome flowers are rather crowded and sessile; the calycine sepals are 3 lines long; the petals 12 lines long, 9 lines broad. The fruit is said to be $3\frac{1}{2}$ in. long.

8. Doxomma rigidum, nob.: ramulis crassis, sulcato-angulatis, dealbatis: foliis majusculis, lanceolato-oblongis, apice sensim acuminatis, imo gradatim acutis, marginibus subrevolutis fere integris et punctis nigris subremotis signatis, rigide coriaceis, supra intense viridibus, opacis, obsolete corrugulatis, ad costam sulcatis, nervis divaricatis semiimmersis, subtus pallidioribus, costa valida, imo sensim incrassata, striolata, fusca, nervisque fuscis prominentibus, marginem versus nexis, venis transversim reticulatis; petiolo valido, imo crassiore, semitereti, fusco, supra sulcato, subtus striolato, limbo 20plo breviore: racemis axillaribus, fructiferis, superioribus folio subæquilongis, inferioribus multo brevioribus, rachi rigida, subflexuosa, alternatim prominenter nodosa: drupis in nodis sessilibus, quadrato-cylindricis, angulis rotundatis, utrinque subtruncatis, lobis calycinis 4, parvis, erectis, rotundatis, concavis, coronatis; pericarpio in fructu immaturo crasse coriaceo, pallido, extus nitido, intus crasse coriaceo, 4-loculari, loculis 3 subabortivis, uno majore, ovulis plerumque marcescentibus. In Malaya: *v. s. in hb. Hook.* (Maingay 767, 2496).

A peculiar species, with stout branchlets 5 lines thick, and axils $\frac{1}{2}$–$\frac{3}{4}$ in. apart; leaves rigid, $9\frac{1}{2}$–$11\frac{1}{2}$ in. long, $3\frac{1}{2}$–$3\frac{3}{4}$ in. broad, on stout rigid curving petioles $1\frac{1}{4}$–$1\frac{1}{2}$ in. long; raceme in the superior axil above 12 in. long, in the lower axils 2–3 in. long, all fructiferous, the flowers having fallen off: the rachis is stout, suberect, angulated, with alternate nodose axils 2–4 lines apart, at first little prominent, but in fruit the nodes are thick and prominent; the fruit, sessile upon them, is, in the immature state, 1 in. long, 4 lines broad.

9. Doxomma macrostachyum, nob.: *Careya macrostachya*, Jack in Calc. Journ. iv. 335; in Hook. Bot. Misc. ii. 88: arbor ramulis lævibus, cinereis: foliis sparsis, obovato- vel oblongo-ovatis, apice obtuso in acumen breve constrictis, imo sensim cuneato-angustatis, tenuiter chartaceis, margine tenui cartilagineo subrevoluto obsolete serrulatis, supra lævibus, læte viridibus, nervis rubellis tenuibus semiimmersis, subtus pallide flaviusculis, costa nervis venisque valde reticulatis prominulis; petiolo subtenui, imo incrassato, supra canaliculato, limbo 5–7plo breviore: racemis dependentibus, rachi crassissima, basi erecta, creberrime multiflora; floribus speciosis, sessilibus, spiraliter enatis, ebracteatis; sepalis 4, rotundatis, glabris, denticulatis, purpurascentibus; petalis 4, triplo longioribus, obtuse ovatis, unguiculatis, rubris; staminibus albis, numerosissimis, imo monadelphis, petalis paullo longioribus; disco plano annulato, margine externo tubum staminigerum fulciente, interno in urceolum elevatum producto, urceolo intus rubro-striato, ore lato integro et flavido, profunde circa stylum ambiente; ovario turbinato, infero, 4-loculari, ovulis 4 in quoque loculo suspensis; fructu (sec. cl. Jack) baccato vel pomiformi. In Penang et Borneo: *v. pl. s. in herb. Hook.* Sarawak (*Beccari* 1535); *fruct. non vidi.*

A tree, with grey bark and smooth branches, found by Jack at Pulo Penang, who

remarks that in its expansive inflorescence, which is very remarkable, it is unlike any known species of *Careya*. I have nowhere met with any plant which agrees with Dr. Jack's description, except that above quoted, found in Borneo by Beccari, the distances between the two places being only 600 miles of intervening sea. Jack's account differs in no respect from Beccari's plant except in the character of his *nectarium*, which is said to be *hypocrateriform*; but this cannot be; it is certainly a mistake, caused by the editor of his notes, in substituting that word for *crateriform*. With this correction, Jack's account admirably conforms with the structure seen in Beccari's plant; we can therefore have little doubt of the specific identity of the two plants. Jack does not give the size of the leaves, though in form both are alike: in Beccari's specimen they are $2\frac{3}{4}$–$5\frac{1}{2}$ in. long, $1\frac{3}{8}$–$3\frac{1}{8}$ in. broad, on slender petioles, thickened at their base, 7–9 lines long. The rachis of the inflorescence, according to Jack, is thick, massive, cylindrical, 8–10 in. long, bearing crowded sessile rather large handsome flowers. In Beccari's specimen the turbinated ovary, 3 lines long, is $1\frac{1}{2}$ line thick at base, 4 lines above; the sepals are 3 lines long and broad; the petals, thick and fleshy, are 10 lines long, 6 lines broad; the stamens, 11 lines long, are seated on a monadelphous tube 1 line long; the elevated expansion of the inner margin of the disk (*nectarium*, Jack) is two lines higher than the disk, but much deeper within and around the style, its entire margin being $2\frac{1}{2}$ lines in diameter: the structure of the ovary is as I have described it. Wallich wrongly referred to this species his *Stravadium angustatum*; Roxburgh was alike in error with respect to his *Barringtonia racemosa*, and Griffith also to his *Careya pendula*, as well as Miquel in regard to his *Stravadium costatum*. All these surmises are without any evidence to support them.

§ 2. *Petioli subbreves.*

10. Doxomma angustatum, nob.: *Stravadium angustatum*, Wall. in Cat. 3637: ramulis crassiusculis, angulato-sulcatis, pallide brunneis, fistulosis: foliis approximatis, lanceolato-oblongis, apice in acumen acutum attenuatis, a medio gradatim cuneatis ad imum angustum subito rotundatis, margine cartilagineo subrevoluto crenatis, et obsoletissime serrulatis, flaccide coriaceis, supra pallidissime glaucis, opacis, nervis tenuibus divaricatis prominulis, reticulatis, subtus fere concoloribus, nervis venisque reticulatis prominentibus, costa striolata paullo prominente; petiolo compresso, latiusculo, supra plano, subtus convexo et striolato, pruinoso, limbo 80–90plo breviore: racemo terminali, stricto, folio multo breviore; rachi cylindrica, undique creberrime florifera; floribus pro genere parvis, sessilibus, bracteolatis; calyce cupuliformi, fere ad basin in sepala rotundata coriacea margine ciliata diviso; petalis 4, sepalis 2plo longioribus, membranaceis; staminibus numerosissimis, imo in tubulum erectum monadelphis; disco annulari, extus tubum staminiferum fulciente, margine interno in prominentiam brevem vertice concavo ambiente producto; ovario infero, quadrato, angulis alis rigide coriaceis crenato-undulatis munito, albide pulverulento, 4-loculari, ovulis 2–4 in quoque loculo suspensis. In Tenasserim: *v. s. in hb. Soc. Linn. et Hook.* Amherst (*Wall. Cat.* 3637 cum not.; an *Careya macrostachya*, Jack?); Tenasserim (*Wall. Cat.* 3637, *Helfors*).

This plant agrees in its general characters with the preceding species, and differs from Jack's plant in its more lanceolate and very pallid leaves, on almost obsolete flat petioles, and its spicated raceme, which is not massive, and its ovary with crenulately undulated wings. The leaves are 9–17 in. long, 3–4¾ in. broad, on petioles 2 lines long, 2 lines broad; the portion of the raceme in the specimen is 6 in. long, 2½ lines thick, closely beset with the rather small cicatrices of the fallen flowers: the calyx is 3 lines long; the ovary of the same length, with broad crenulated winged angles; the petals are 6 lines long, 3 lines broad.

11. Doxomma Vriesii, nob.: *Barringtonia Vriesii*, Teijm. & Benn. Nat. Tijd. Ned. Ind. ii. 308; Kruidk. Arch. iii. 411; Miq. Fl. Ned. Ind. i. 491 et 1087; Walp. Ann. iv. 852: arbor mediocris, ramulis roridis, hepatice viridibus: foliis oblongo-lanceolatis, apice anguste acuminatis, imo cuneatim acutis, marginibus obsolete serrulatis, utrinque glabris, supra lucide viridibus, costa plana; petiolo hepatico, supra plano: racemo terminali, rachi valida, erecta, folio longiore, spicatim densiflora, pedicellis roridis, imo bibracteolatis; petalis speciosis, albido viridulis: fructu majusculo, oblongo, utrinque sensim attenuato, tetragono, hepatice viridi. Java, in prov. Bantam (*non vidi*).

This is said to be a handsome tree, not very high, with wide-spreading branches, growing in moist places: its leaves are 4–5½ in. long, 1½–2 in. broad, with liver-coloured petioles: the raceme is erect, 4–7 in. long, with numerous very handsome approximated flowers, having whitish-green petals, which, with the stamens, fall off in great numbers, and appear like a party-coloured carpet beneath the tree. Miquel, in his diagnosis, which is an exact copy of that of the Dutch authors, by mistake, says "baccæ verrucosæ," not observing the typical error in the original, "drupis verrucibus" for "drupis viridibus," the latter being so described in their annotation. Miquel admits that he never saw the plant, not even a dried specimen of it, nor its fruit. He adds that the genus to which it belongs is doubtful, because of its bibracteolated flowers, and suggests, without any reason, that it may be the *Planchonia Timoriensis*, Bl. But subsequently he again falls into error, stating positively that it is identical with the *Barringtonia excelsa*, Bl.; but this cannot be admitted, because the latter is a very lofty tree, with a remarkable and different inflorescence; and, notwithstanding this, he again suggests that it may be the type of a new genus. I have no doubt that it belongs to *Doxomma*, of which it presents all the characters, especially in its stout erect rachis densely covered with numerous handsome bracteolated flowers. Teijmann and Bennindijn describe the fruit as a little longer than a goose's egg, pointed at both extremities, and liver-coloured.

12. Doxomma magnificum, nob.: ramulis validissimis, summo breviter constrictis et setaceo-ramentosis, dein crassioribus et cicatricibus petiolorum magnis creberrime signatis: foliis majusculis, elongato- et late oblongis, apice in acumen brevissimum obtusum constrictis, sub medium cuneato-angustatis et circa petiolum subito rotundiusculis, in marginibus incrassatis, obsolete serrulatis, subcoriaceis, supra pallidissime viridibus, opacis, nervis remotis arcuatim adscendentibus tenuibus vix prominulis,

reticulatis, costa valida, imo sensim crassiore, subtus palidissime lutescentibus, nervis costatis, venis prominulis, costa convexa, valde prominente; petiolo latissimo semitereti, limbo 30plo breviore: racemo terminali, longissimo, mox pendulo; rachi cylindrica, crassissima, profunde striata, subcrebriflora; floribus in paribus superpositis et sessilibus, imo bractea majuscula lanceolata decidua munitis; calyce cupuliformi, fere ad basin in lobos 4 imbricato-oblongos concavos carnosulos diviso, extus brevissime puberulo; petalis 4, oblongis, marginibus late revolutis, calyce 3plo longioribus, viridi-albidis, expansis; staminibus numerosissimis, imo in tubulum erectum monadelphis et cum petalis imo agglutinatis simul caducis; disco annulato, margine externo tubum staminigerum fulciente, intus in prominentiam elevatam styli basin cingentem producto; ovario subcylindrico, tetragono, obsolete puberulo, 4-loculari: fructu immaturo subparvo oblongo-ovato, utrinque obtuso, calyce coronato, quadrato, angulis subalatis, abortu 1-loculari et monospermo. In Tenasserim: *v. s. in hb. Hook.* Tavoy (*Parish*).

A tree 30–40 feet high, with a straight trunk and a fine head of spreading branches, called by the natives *kyai-gyee*; it is also found at Moulmein. It forms a species quite distinct from most of the preceding, differing in its much broader leaves, on short petioles, and in its flowers arranged in pairs, and its fruit with winged margins. Its leaves, very crowded at the extremity of the branches, are 16 in. long, 6 in. broad, on a petiole 6 lines long, 4½ lines broad, with about 13 pairs of very spreading nerves; raceme upwards of 3 feet long, rachis 6 lines thick below; pedicels 1 line long; calyx 4 lines long; petals 10 lines long, 6 lines broad; stamens above an inch long; fruit (perhaps immature) 11 lines long, 8 lines broad, quadrate, with winged margins, its single seed is suspended, 5 lines long.

8. Petersia.

This is a singular genus, proposed by Dr. Welwitsch for a plant discovered by him in Angola, a tree of large size, with an expanded comose head: it has terminal pendent racemes, on a rather thin rachis, bearing many small flowers, each upon a long slender pedicel, which is bibracteolated in the middle; the calycine limb consists of 4 small rounded erect sepals, distinct in the bud; 4 obtuse petals, fixed by their claws to the staminiferous tube; an inferior turbinate 4-winged ovary, which is 4-locular, with several ovules suspended in the summit of each cell; the fruit is of a narrow linear cylindrical shape, coarsely hispid, with 4 very large extremely broad membranaceous wings. By abortion it is unilocular, with few linear compressed suspended seeds.

Petersia, Welwitsch.

Calycis adnati *limbus* in sepala divisus. *Sepala* 4, rotundata, erecta, ciliata, in æstivatione subimbricata, persistentia. *Petala* 4, cuneato-oblonga, membranacea, calyce longiora, unguibus ad tubum staminigerum affixa, et cum illo caduca. *Stamina* numerosissima, multiseriata, imo in tubum brevem cylindricum monadelpha: *filamenta* tenuia crispatim flexuosa; *discus* anguste annularis, externe tubum staminigerum fulciens, interne in urceolum brevem productus; *stylus* tenuis, longitudine staminum; *stigma* parvum, clavatum. *Ovarium* inferum lineari-turbinatum, 4-alatum, alis imo obsolete 4-lobatis in pedicellum deliquescentibus, apice rotundatis, sepalis alternis, 4-loculare: *ovula* in

quoque loculo plurima, axi summo suspensa. *Fructus* lineari-cylindricus, latissime 4-alatus, *alis* magnis, latissimis, apice profunde semicordatis, membranaceis, crebre parallele et horizontaliter nervosis; *pericarpium* lineare, tenuiter fibroso-coriaceum, abortu 1-loculare; *semina* pauca, lineari-oblonga, compressa, subimbricatim ab apice suspensa.

Arbor *Angolensis, grandis, frondosa:* folia *alterna, elliptico-oblonga, utrinque acuta, breviter petiolata;* racemus *terminalis, brevis, pauciflorus;* flores *alternatim pedicellati, inconspicui;* fructus *singulariter late 4-alatus, majusculus.*

Petersia africana, Welwitsch, Hook. & Benth. Gen. Pl. i. 721; Oliv. Fl. Afr. Trop. ii. p. 439: procera, coma magna dilatata, apice depressa, ramis dependentibus: foliis epunctatis, oblongo-ellipticis, apice in acumen acutum subito constrictis, imo sensim cuneatis, marginibus obsoletissime serratis, subcoriaceis, supra sublucidis, intense viridibus, nervis tenuibus divaricatis marginem versus nexis vix prominulis, subtus pallidioribus, opacis, nervis prominulis in axillis barbatis; petiolo tereti, marginato, limbo 12plo breviore: racemis in ramulis novellis terminalibus aut subaxillaribus, folio brevioribus, paucifloris; floribus subparvis, longe pedicellatis; pedicellis tenuibus, elongatis, medio bibracteolatis, bracteolis parvis, lanceolatis, oppositis, puberulis; calycis limbo in sepala 4 semiovata erecta puberula ciliata diviso; petalis 4, rotundo-oblongis, glabris, unguibus tubo staminigero agglutinatis; staminibus numerosissimis, petalis longioribus, imo in tubum brevem erectum monadelphis; ovario infero, turbinato, 4-alato, alis latiusculis, ciliatis, 4-loculari, ovulis in quoque loculo plurimis, pluriseriatis, axi centrali affixis: fructu lineari, tetragono, latissime 4-alato, alis membranaceis, glabris, parallele nervosis, superne profunde cordatis; pericarpio extus setis rigidis hispido, textura fibroso; endocarpio tenuiter coriaceo, aborto 1-loculari, axi e loculis abortivis hinc parietali; seminibus 4–5, linearibus, compressis, imbricatis, funiculis ab apice suspensis. In Africa occidentali, in convallibus humidioribus Monte de Quetecati, distr. Cal. alto, regno Angolensi: *v. s. in hb. Hook.* (*Welwitsch*).

An immense tree, 50 feet high, its trunk 4 feet in diameter to a height of 20 feet, when it throws out many spreading and somewhat pendent branches, forming a head rather depressed at its summit. The leaves are $3\frac{1}{2}$–$6\frac{1}{2}$ in. long, $1\frac{1}{2}$–$2\frac{1}{2}$ in. broad, on petioles 3–6 lines long, having 12–14 pairs of nerves, with a tuft of hairs at their origin: it is stated (Hook. & Benth. Gen. Plant. i. p. 721) that its leaves are pellucidly punctate. I contested this point with the late Dr. Welwitsch, showing him that in all the younger leaves, and in nine cases out of ten, no pellucid dots are visible, and that where they were present, this was due to round globules of transparent matter deposited by insects in the parenchyma, sometimes in clefts made by them, sometimes appearing like raised glands. The terminal raceme is 3 in. long, on a rather slender rachis; the pedicels are 6–9 lines long, bearing in their middle (where they are articulated) 2 opposite lanceolate bracts $1\frac{1}{2}$ line long; the ovary is 2 lines long, is broadly 4-winged; the sepals 1 line long; the petals 4 lines long, 2 lines broad; the stamens 5 lines long; the style 6 lines long. The fruit is altogether $2\frac{3}{4}$ in. long, $2\frac{1}{2}$ in. broad, the wings deeply cordate at the summit; the central pericarpial portion begins at the deep sinus between the wings, extending down-

wards to the base; this portion is almost spinosely hirsute exteriorly: its texture consists of loose rigid longitudinal fibres without any agglutination; and, by abortion, it is only 1-celled, lined with a thinnish coriaceous endocarp, is 12 lines long and 2 lines in diameter; by the abortion of 3 of the cells, the central placental axis becomes parietal; and upon it I observed four or five imbricated seeds, linear and much compressed, $3\frac{1}{2}$ lines long, $\frac{1}{2}$ line broad, suspended from the summit by a broad funicle 2 lines long; the embryo I could not make out. Dr. Welwitsch, in his note, quoted in the 'Genera Plantarum,' states he did not find perfect seeds; but the above details were obtained from a fruit, flowers, and plant kindly given to me by the late Dr. Welwitsch.

A drawing of this species (with its floral and carpological analyses) is shown in Tab. XVIII. figs. 16 to 26.

9. Megadendron *.

This genus is proposed for two handsome Java plants, very lofty trees, one of which is the *Barringtonia macrocarpa*, so well described by Hasskahl in 1844: it has large long leaves, and bears much resemblance in its handsome flowers, upon a long terminal raceme, to those of *Doxomma*; but it differs from that genus in the constantly variable number of its sepals and petals, in the inflected margins of its erect sepals (free even in æstivation), in the position of its ovules, and in its much more elongated fruit.

Megadendron, nob.

Barringtonia, Hassk. et Bl. (non Forst.).

Sepala 2, 3, 4, libera, acute oblonga, chartacea, parallele nervosa, erecta, jam inde in æstivatione marginibus involutis et ad se applicitis, persistentia. *Petala* 4, 5, 6, duplo majora, oblonga, æstivatione imbricata, dein expansa, lateribus retroflexis, unguibus tubo staminigero agglutinata, et cum illo caduca. *Stamina* numerosissima, in tubum brevem imo monadelpha; *filamenta* filiformia, pluriseriata, petalis longiora, seriebus interioribus anantheris et capillaribus; *antheræ* parvæ, 2-loculares. *Discus* epigynus, plane annularis, margine exteriore tubum monadelphum fulciens, interiore in urceolum brevem latum expansus. *Stylus* filiformis, longitudine staminum; *stigma* parvum. *Ovarium* inferum, turbinatum, vertice intra urceolum et stylum concavo, 4-loculare, ovulis in quoque loculo 5–6 (raro 2–4) axi radiatim affixis. *Fructus* majusculus, elongato-cylindricus, utrinque obtusatus, calyce persistente styloque coronatus; *pericarpium* crassum, fibroso-coriaceum, abortu 1-loculare et monospermum. *Semen* loculum implens, cylindricum, utrinque subattenuatum, obsolete tetragonum: *testa* fusca, submembranacea; *embryo* exalbuminosus, amygdalinus, mesopodus, siccus *exorhiza* ad utramque extremitatem in fissuras 4 hiante.

Arbores *Timorenses et Javenses, excelsæ, ramosæ;* folia *majuscula in apicibus ramorum congesta, oblonga vel lanceolata, fere integra, petiolata;* flores *speciosi, in racemo terminali sparse spicati.*

1. Megadendron macrocarpum, nob.: *Barringtonia macrocarpa*, Hassk. Diagn. Nov. p. 504; in Cat. Hort. Bogor. p. 263; in Bot. Zeit. xxvii. 598 (1844); Miq. Fl. Ned. Ind. i. 485 (1855): *Barringtonia racemosa*, var. *elongata*, Bl. in Van Houtte, Fl. Serr. vii. 24: arbor alta, ramis crassis, cinerascentibus: foliis in summo ramulorum crebre congestis, late oblongis, apice acuminatis, infra medium subito cuneatis, ad marginem subrevolutum crenato-serratis, coriaceis, glaberrimis, supra profunde viri-

* Ἀ μέγας (*magnus*), δένδρον (*arbor*).

dibus, nervis paullo prominulis, costa plana, imo incrassata, subtus pallidioribus, nervis validis, albescentibus; petiolo brevi, crasso, semitereti, late marginato, atroviridi, limbo 70plo breviore: racemo terminali, pendulo, folio æquilongo; floribus speciosis, sparse spicatis, pedicellatis; sepalis 2, 3, 4, acutis, erectis, marginibus anguste inflexis, chartaceis, parallele nervosis; petalis 4, 5, 6, obovatis, triplo longioribus, lateribus undulato-reflexis, albis; staminibus disco styloque ut in char. gen.; ovario infero, 4-loculari: fructu elongato-cylindrico, structura in char. gen. descripta. In Java et in insulis Sondaicis: *v. s. in hb. Mus. Brit.* Patjetan (*Horsfield*); *in hb. Hook.* Straits Sunda (*Staunton*); *fruct. non vidi.*

A lofty tree, with spreading branches; its leaves are 10–18 in. long, 4–6 in. broad, on stout petioles 2 lines long and broad; raceme more than a foot long, with flowers $\frac{1}{2}$–$\frac{3}{4}$ in. apart, $2\frac{1}{2}$ in. in diam.; pedicels stoutish, nearly $\frac{1}{2}$ in. long; ovary the length of the sepals, which are 4 lines long; petals 9–12 lines long; staminiferous tube $\frac{1}{10}$ in. long; exterior filaments $1\frac{1}{4}$ in. long, interior ones short, capillary without anthers; fruit 5 in. long, $1\frac{1}{4}$ in. broad at the angles, 1 in. broad at the sides; cell of pericarp $2\frac{3}{4}$ in. long; the seed fills the cell. Blume regarded this plant as a variety of *Butonica racemosa*, naming it *elongata*, on account of its very long cylindrical fruit. Hasskahl gave copious and exact characters of this plant, which is almost the only species in the family well described; for Blume and Miquel have given only laconic characters, often contradictory and incomplete. Had they followed the example of Hasskahl, we should have obtained a much better knowledge of the family.

A drawing of this species (with its floral and carpological analyses) is shown in Tab. XV. figs. 1 to 8.

2. Megadendron pallidum, nob.: foliis longe lanceolatis, apice sensim acuminatis, imo gradatim longe cuneatis, subsessilibus, sinuato-serratis vel marginibus subrevolutis, hinc punctis nigris remotis signatis, subcoriaceis, supra pallidissimis, nervis remotis subrecto-divergentibus marginem versus nexis, costa plana, immersa, imo gradatim valde incrassata, subtus fere concoloribus, costa nervisque prominentibus; petiolo vix ullo: racemo terminali, pendulo, rachi subtenui, compresse striata; floribus subsparsis, brevissime pedicellatis; sepalis 2–3, acutis, rectis, concavis, marginibus anguste involutis (petalis et staminibus lapsis); ovario infero, oblongo, obsolete tetragono, superne disci urceolo stylum ambiente notato, 4-loculari, loculis 3 cum ovulis abortivis, in altero ovulo magno pendulo. In Java: *v. s. in. hb. Mus. Brit.* loc. cit. (*Horsfield*).

A species evidently belonging to this genus: its leaves are $19\frac{1}{2}$ in. long, $4\frac{5}{8}$ in. broad, quite sessile; the rachis of the raceme is not very stout, 15 in. long; pedicels 3–6 lines apart, less than 1 line long; ovary grown after the fall of the petals is $\frac{3}{4}$ in. long, crowned by 2, sometimes 3 sepals 5 lines long, $2\frac{1}{2}$–3 lines broad at the base.

3. Megadendron? ambiguum, nob.: *Barringtonia timorensis*, Blume in Van Houtte, Flor. Serr. vii. p. 25; Miq. in Fl. Ind. Ned. i. p. 485: foliis oblongis vel elliptico-oblongis, apice acutis aut acuminatis, infra medium subcuneatis, basi subacutis

vel obtusis, obsolete serrulatis, nervis tenuibus, remotiusculis; petiolo limbo 30–40plo breviore: racemo terminali, spicatifloro, longissimo, rachi crassiuscula, erecta, vel subnutante, glabra; floribus ignotis: fructu ovoideo, acute tetragono. In ins. Timor: *non vidi.*

A species ambiguous in its relations. Blume places it next to his *Barringtonia racemosa*, which is numerous in synonyms, the chief of which is his var. *elongata*, the type of this genus. Miquel's description of this species is a mere repetition of Blume's unsatisfactory diagnosis. It appears to me to belong to *Megadendron*, not only on account of the country of its origin, but its general habit, its long pointed cuneated leaves, suddenly rounded at base upon an extremely short petiole, a terminal long raceme, with an erect thickened rachis—characters peculiar to the genus to which I have assigned it. Blume and Miquel refer it to the *Barringtonia acutangula*, Spanaghoe, a species known by name only, without any given character, and evidently unknown to them. Blume states that the leaves in this species are 4–10 in. long, $1\frac{1}{2}$–$4\frac{1}{4}$ in. broad, on petioles only 2–3 lines long. No other dimensions are given.

10. Chydenanthus.

This new genus[1] is founded upon a plant which differs from all others of the family in having a branching paniculated inflorescence, and which was originally described by Blume in 1826 under the name of *Barringtonia* or *Stravadium excelsum.* It is a native of Java, a lofty tree, with broadly spreading branches and long pointed leaves; the terminating panicle, longer than its large leaves, has alternate branches, presenting at rather short intervals alternate very prominent nodes, each having articulated upon it a sessile ebracteated flower of moderate size: the calyx is peculiar, of a cup-shaped form, with an almost entire margin, broadly open in the bud; it has 4 oblong petals, attached by their claws to the staminiferous tube as in the other genera; there is a peculiarity in the stamens in having most of the filaments antheriferous, while the 2 or 3 inner rows are reduced to the form of slender barren pointed hairs: the inferior ovary is cylindrical, 8-grooved, 2-locular, with a single ovule erect in each cell: the fruit, according to Blume, is like that of *Stravadium* in form.

Chydenanthus, nob.

Stravadium, Bl.; *Barringtonia*, Miq.

Calycis adnati *limbus* hemisphærice cupuliformis, margine truncatus, vix lobatus, ciliolatus, subcoriaceus, persistens. *Petala* 4, obovata, quorum 2 paullo majora, calyce 4plo longiora, membranacea, unguibus ad tubum staminigerum affixa, et cum illo caduca. *Stamina* numerosissima, multiseriata, imo in tubum cylindricum monadelpha, seriebus exterioribus fertilibus, interioribus multo brevioribus, tenuioribus, ad basin fere liberis, anantheris. *Stylus* tenuis, æquilongus. *Discus* plane annularis, margine externo tubum staminigerum fulciens, intus in prominentiam erectam expansus. *Ovarium* inferum, semiglobosum, 2-loculare: *ovula* in quoque loculo solitaria, erecta. *Fructus* elongato-ellipsoideus, utrinque obtusus, tetragonus: cætera ignota.

Arbor *Javensis procera, frondosa*; folia *lanceolato-oblonga, utrinque acuta, subobsolete serrata, breviter*

[1] From χύδην (*diffuse*), ἄνθος (*flos*).

petiolata; inflorescentia *terminalis vel subaxillaris, singulariter paniculata, rachi pubescente, ramis pedunculatis, alternatim longe nodosis;* flores *sessiles, cum nodis articulati et plerumque tandem caduci, speciosi;* fructus *cylindrice oblongus, vix notus.*

1. Chydenanthus excelsus, nob.: *Barringtonia excelsa*, Blume (non Benth.), Bijdr. 1097; Miq. Fl. Ned. Ind. i. p. 491: *Stravadium excelsum*, Bl. in DC. Prodr. iii. 289; Bl. in Van Houtte, Fl. Serr. vii. p. 24: arbor alta, ramulis pallide brunneis, opacis: foliis oblongo- vel lanceolato-ellipticis, apice subito et acute attenuatis, imo obtusis vel acutioribus, marginibus cartilagineis subrevolutis vix repando-serratis, chartaceis, supra pallide viridibus, valde opacis, sub lente granulosis, nervis tenuissimis subadscendentibus arcuatim nexis, semiimmersis, costa tenui, subtus pallide fulvescentibus, opacis, minute granulosis, costa nervis stramineis venisque transversim reticulatis subprominentibus; petiolo semitereti, corrugulato, limbo 20plo breviore: racemis axillaribus et simplicibus, folio dimidio brevioribus, vel terminalibus, longioribus et ramoso-paniculatis, fulvide tomentellis, ramis remotis aut verticellatim congestis, imo (ut in axillaribus) nudis, supra medium spicati-floris, nodis crassis projectis, alternis, erecto-divaricatis, singulis 1-floris; floribus hinc sessilibus et articulatis, plerumque caducis; calycis limbo cupuliformi, margine membranaceo, undulato, obsolete 4-lobato, griseo, puberulo; petalis 4, obovatis, quorum 2 paullo majoribus, membranaceis, minute puberulis, unguibus tubo staminigero affixis; staminibus numerosissimis, petalis longioribus, imo in tubum brevem monadelphis, seriebus interioribus eximie brevioribus, tenuioribus, anantheris, ad basin fere liberis; disco annulari, extus tubum staminigerum fulciente, margine interno in tubulum crassum sulcatum stylum ambiente expanso; ovario infero, cylindrico, 8-sulcato, distincte 2-loculari, ovulo unico in quoque loculo e basi erecto: drupa elongato-ellipsoidea, utrinque obtusa, tetragona. Java, in maritimis: *v. s. in hb. Mus. Brit.* Prowats (*Horsfield*); in hort. Bogor cult. (*Anderson*); *in hb. Hook.* Java (*a cl. Miquel missa*): *fructus non vidi.*

Miquel's specimen certainly belongs here, and, though named by him *Barringtonia Vriesii*, does not correspond with the species published under that name by Teysmann and Bennenden. The details given by Blume are extremely short. He describes it as a tree 80 feet high; its leaves are 5–7¾ in. long, 2–2¾ in. broad, on petioles 3–4 lines long. This is one of the rare instances hitherto known in the family where a paniculated inflorescence occurs; this is accompanied by other characters, showing it to form a distinct genus: the rhachis is 4–10 inches long, with 4 alternate branches somewhat distant, 2–3 in. long in one specimen, while in another these branches are fasciculated or alternate upon a common peduncle 2 in. long; each branch has many projecting alternate thick nodules 1–2 lines long and 1–2 lines apart, each supporting a sessile flower articulated upon it: the ovary is like a pedicel, 1 line long, ½ line thick; the cupular calyx is 2 lines long, 3 lines broad; the petals are submembranaceous, horizontally extended, two of them 9 lines, the others 8 lines long, and 4½ lines broad; the outer stamens, 1 inch long, are united at their base into a tube 2½ lines long, the inner ones are almost free to the base, finely capillary, 3 lines long, and without anthers.

Miers, del.

BARRINGTONIA SPECIOSA.

Maclure & Macdonald, Lith, London

Miers, del. D. Blair, Auto-lith.

Maclure & Macdonald, Lith. London

AGASTA SPLENDIDA

Blume makes this species a section (*Anisostemon*) of his *Stravadium*, distinguished by its peculiar inflorescence and its remarkably short interior stamens.

Blume, in his Bijdragen, p. 1087, says that this plant is the same as the *Barringtonia Vriesii* of Teysmann and Bennenden, which he suggests should be expunged. But Miquel does not accord in this view, and he quotes afresh the details given by the latter authors, that the inflorescence is an erect terminal raceme with dense flowers, seated upon separate pedicels bibracteolated at their base. He thinks it should be placed in a separate genus; but he confesses that he had not seen any specimen of it. I have referred it to the genus *Doxomma*.

A drawing of this species (with its floral analysis) is shown in Tab. XVII. figs. 15 to 20.

DESCRIPTION OF THE PLATES.

Plate X.

Fig. 1. A leaf of *Barringtonia speciosa*, from Forster's own specimen.
2. A flower of the same in bud, showing its entirely closed calyx.
3. The flower expanded, copied from Forster's drawing.
4. The stamens of the same, combined in a monadelphous tube, which is cut open, and to which one of the petals is affixed by its claw: *all nat. size.*
5. One of the anthers: *much magnified.*
6. The ovary, with the persistent calyx, the disk, with its inner nectarial expansion, and style: *nat. size.*
7. A longitudinal section of the same, showing two of its four cells, with its suspended ovules, the epigynous disk, which supports the staminal tube on its outer margin, is crenately lobed in the middle, and with its outer margin expanded into a long tube, dentated at its apex, and surrounding the lower part of style.
8. The fruit crowned by the persistent calyx.
9. The same, with half of the sarcocarp cut away transversely, to show the fibres surrounding the endocarp.
10. The endocarp, with its surrounding fibres.
11. A transverse section of the 4-celled endocarp, with one of the enclosed seeds shown.
12. The embryo of the seed: *all nat. size.*

Plate XI.

Fig. 1. The flower, in bud, of *Agasta splendida*, showing its entirely closed calyx.
2. The same, with the calyx splitting into 2 lobes by the expansion of the petals.
3. A flower expanded upon its pedicel, which has a foliaceous bract in its middle, copied from Parkinson's drawing.
4. A longitudinal section of the ovary, calyx, staminal tube, seated on the outer margin of the epigynous crenated disk, and style; two of its four cells are seen with the suspended ovules.
5. A transverse section of its 4-celled ovary.
6. A longitudinal section of the drupe, crowned by the persistent calyx and style, and its single large seed enclosed in its rather thick pericarp: *all nat. size.*

Plate XII.

Fig. 1. Flower in bud of *Agasta indica.*

2. Calyx, opened, and ovary, from which the petals and stamens have fallen away.
3. One of the petals.
4. The stamens united into a monadelphous tube, which is cut open to show its form, the petals having been detached.
5. A longitudinal section of the calyx and ovary, showing two of its four cells, and surmounted by the style and disk, from the outer margin of which the staminal tube has fallen.
6. A transverse section of the ovary, showing its 4 cells.
7. The fruit crowned by the persistent lobes of the calyx; a quarter of the pericarp is cut away, to show the single suspended seed, marked by a groove left by pressure of the chord formed by the 3 abortive cells.
8. The fruit seen from below, showing its acutely quadrate form.
9. A transverse section of the mesopodal embryo, showing the line of junction of the exorhiza and neorhiza: *all nat. size.*

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10. The flower in bud of *Agasta asiatica,* with the bract at the base of the pedicel.
11. One of the four petals.
12. The monadelphous stamens combined at the base into a tube, which has fallen away from its attachment upon the outer margin of the disk.
13. The ovary, surmounted by the persistent lobes of the calyx, disk, and style.
14. A longitudinal section of the same, showing two of its four cells, the style, the disk with its inner margin expanded upwards, and its outer margin, from which the staminiferous tube has fallen.
15. A transverse section of the ovary, showing its 4 cells.
16. A fruit acutely 4-angled, the angles cordate at base upon the pedicel, surmounted by the persistent lobes of the calyx and the style: *all nat. size.*

Plate XIII.

Fig. 1. A flower in bud of *Butonica alba.*

2. The same after expansion.
3. The same, seen from below, showing its 4-lobed calyx, its 4 petals with retroflected margins.
4. The staminal tube with the petals attached, falling away from fig. 5.
5. The pedicel, ovary, and persistent calyx of the same, the corolla and stamens having fallen off.
6. A longitudinal section of the ovary, with the persistent calycine lobes, disk, and style.
7. A transverse section of the same, showing its 4 cells.
8. A diagram showing the æstivation of the petals.
9. A drupe of the same, according to the dimensions given by Rumphius (it appears smaller in his diminished plate 115): a quarter of the pericarp is cut away longitudinally, to show the single suspended seed.
10. A transverse section of the embryo, showing the line of junction of the exorhiza and neorhiza: *all nat. size.*

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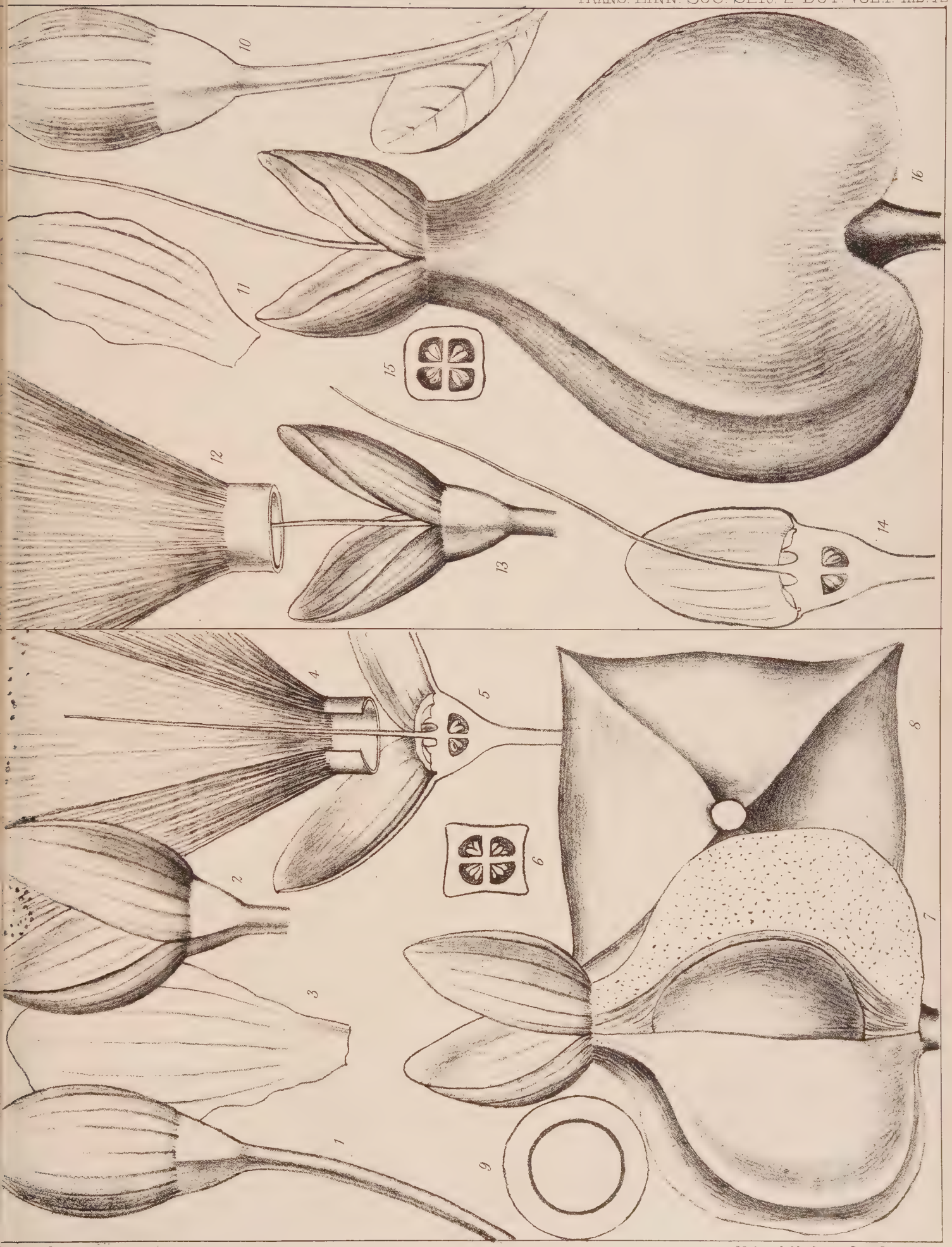
11. A portion of the raceme of *Butonica racemosa,* with the flower expanded.
12. A flower in bud, of the same.
13. One of the four petals separated (which are attached by their claws to the staminiferous tube).
14. The stamens united at base into a monadelphous tube, which is cut open, and which has fallen off from the external margin of the disk.



AGASTA ASIATICA

AGASTA INDICA

ers. del. D. Blair, Auto-lith

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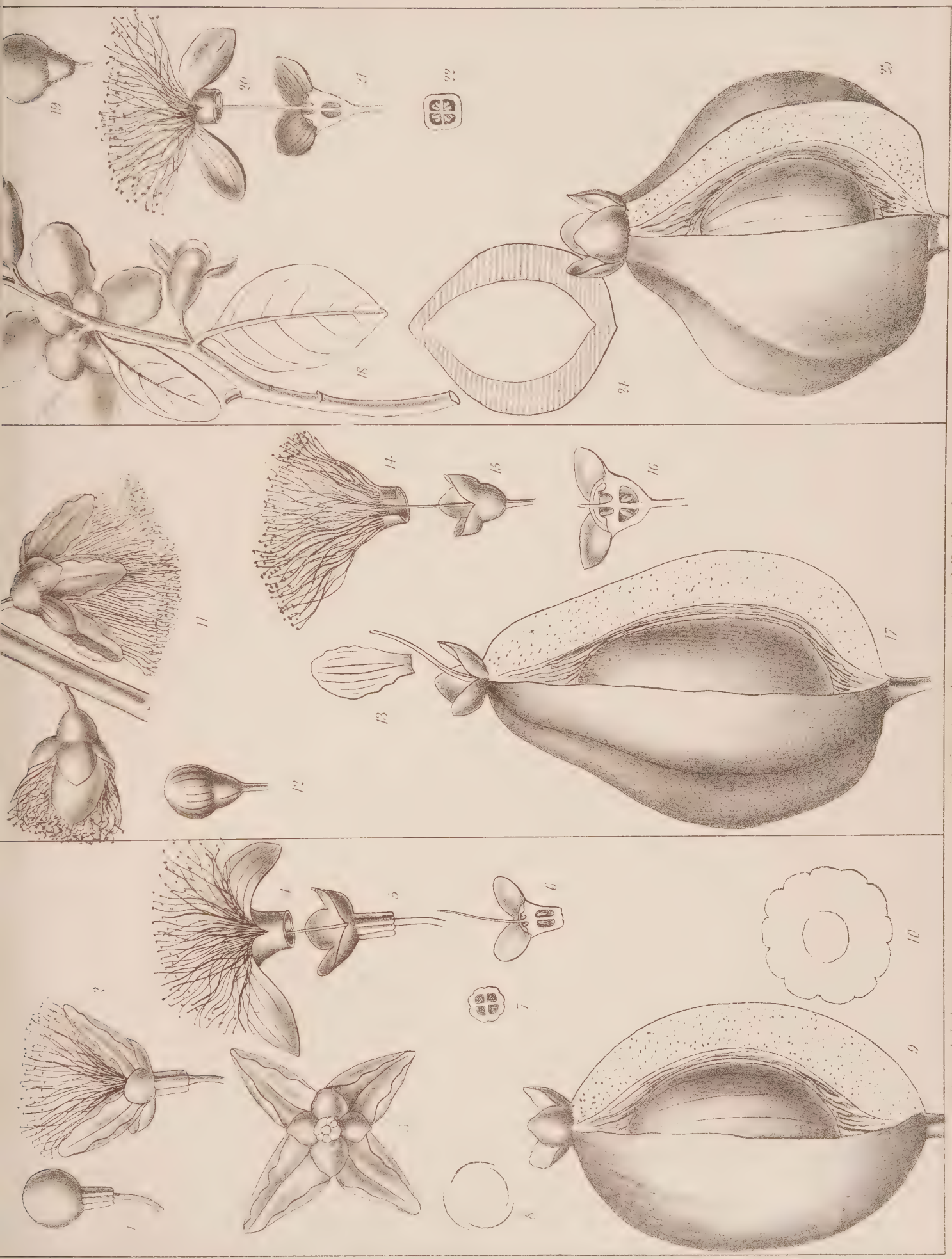

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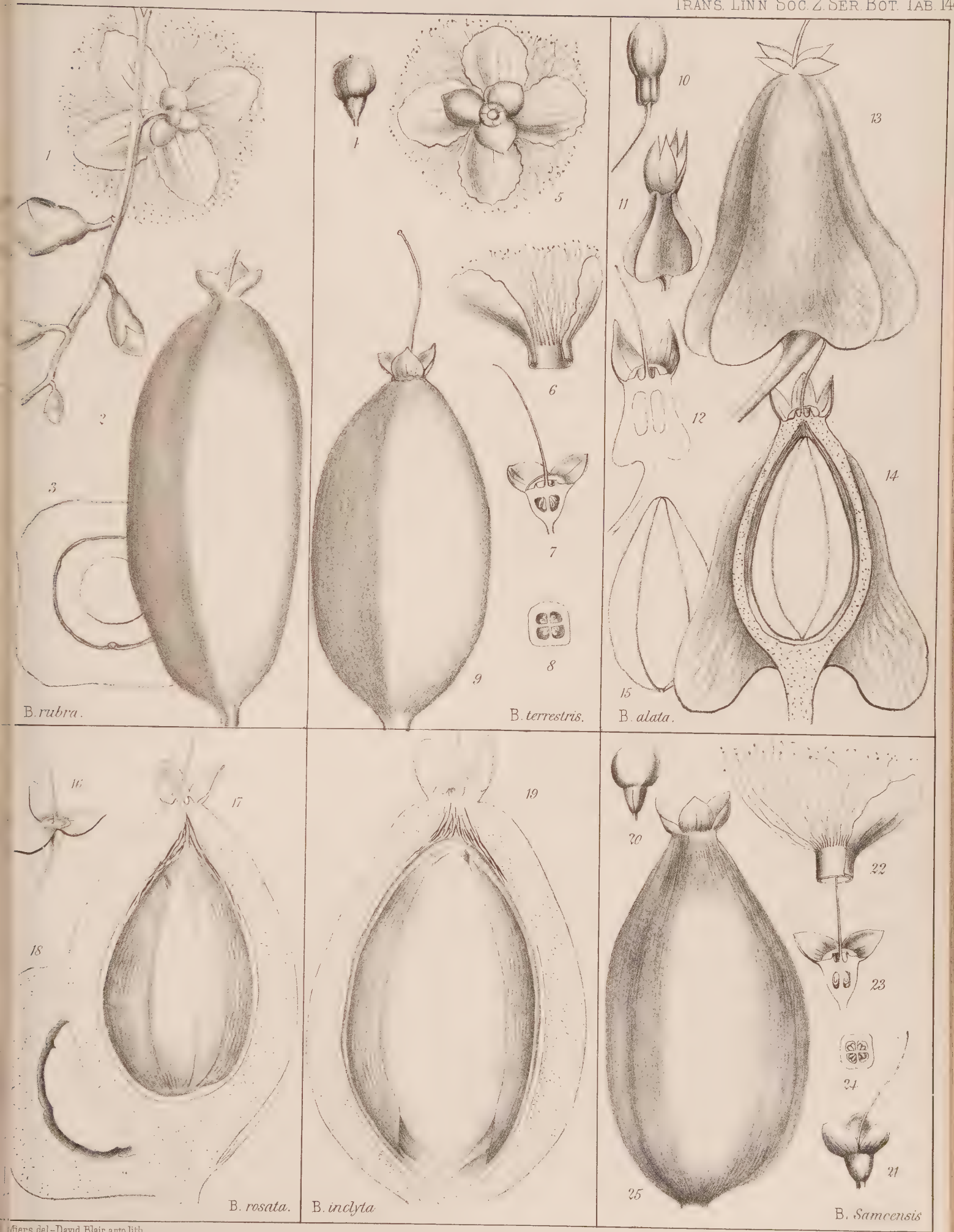

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BUTONICA

15. The ovary surmounted by the calycine lobes and style, the staminiferous tube having fallen off.
16. A longitudinal section of the ovary, disk, and style, showing two of its four cells.
17. The drupe according to the shape and size given by Rheede, Roxburgh, and Hermann; a quarter of its pericarp is cut away, to show the single enclosed seed: *all nat size.*

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18. A portion of the raceme of *Butonica Rumphiana* with the flowers in bud.
19. A flower in bud on its pedicel.
20. The petals and stamens of the same, expanded, and agglutinated to the monadelphous tube, which has fallen from the external margin of the disk.
21. A longitudinal section of the ovary surmounted by the calycine lobes, disk, and style.
22. A transverse section of the 4-celled ovary.
23. The drupe, according to the dimensions given by Rumphius, surmounted by the persistent calycine lobes; a quarter of its pericarp is cut away, to show the single enclosed seed.
24. A longitudinal section of the embryo, showing the neorhiza enclosed within the exorhiza: *all nat. size.*

Plate XIV.

Fig. 1. A portion of the raceme of *Butonica rubra,* with flowers in bud, and another expanded.
2. A drupe of the same, according to the shape given in the diminished drawing of Rheede, but enlarged to its proper dimensions.
3. A transverse section of the same, showing within the pericarp the neorhiza of the embryo surrounded by its exorhiza: *all nat. size.*
4. A flower in bud of *Butonica terrestris,* with its calyx entirely closed.
5. The same fully expanded, as seen from below, showing the 3 ruptured lobes of the calyx, the 4 petals, and the stamens.
6. The stamens united into a monadelphous tube, which is cut open, showing two of the four petals agglutinated to it by their claws.
7. A longitudinal section of the 4-celled ovary, with two of the cells and their suspended ovules, two of the lobes of the calyx, the epigynous disk, from the outer margin of which the staminal tube has fallen off, the inner margin being raised, with the style seated in the hollow vertex.
8. A transverse section of the same.
9. A drupe of the same, according to the dimensions given by Rumphius (it appears smaller in the diminished drawing of his plate 115): *all nat. size.*

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10. A young bud of *Butonica alata,* with the calyx quite entire.
11. The same somewhat grown, with the calyx beginning to split into 4 lobes.
12. A longitudinal section of the same, showing two of its four cells, the epigynous disk with its inner margin elevated.
13. A full-grown fruit, from a specimen in the Museum of the Linnean Society.
14. A longitudinal section of the same, showing the form of its 4-winged pericarp, its single seed enclosing the embryo.
15. The embryo extracted, with its exorhiza surrounding the neorhiza, and easily separable from it: *all nat. size.*
16. The ovary, disk, calycine lobes, and style of *Butonica rotata.*
17. A fruit of the same, shown in longitudinal section, according to the dimensions given by Sonnerat.
18. A transverse section of the same, including the seed: *all nat. size.*

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19. The fruit of *Butonica inclyta*, according to the dimensions given by Griffith under the name of *Barringtonia racemosa* (but not of Blume) : this is is seen in his plate 636, § 2, with analytical details, figs. 1–6, and is here seen in longitudinal section : the embryo of the seed is shown with its neorhiza beginning to separate from the exorhiza, the latter splitting into 4 lobes at both extremities, as in *Doxomma cochinchinense*.

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20. A flower-bud of *Butonica samoensis*, the entire globular limb of its calyx being quite closed.
21. The ovary, with the limb of the calyx split into 3 lobes.
22. The stamens combined into a monadelphous tube, to which one of the four petals is shown attached by its claw, all having fallen from the disk.
23. A longitudinal section of the ovary, with two of its three calycine lobes, the epigynous disk, on the outer margin of which the staminal tube was seated, its inner margin being considerably raised, forming the deep hollow in the vertex in which the style originates.
24. A transverse section of the ovary, showing its 4 cells.
25. The drupe, of the size and shape figured by Gaudichaud under *Barringtouia racemosa*: *all nat. size.*

Plate XV.

Fig. 1. A portion of the raceme of *Megadendron macrocarpum*, from Horsfield's specimens and the excellent description of Hasskahl, showing flowers in bud, and another fully expanded, seen from beneath, with its 4 sepals, 4 petals with reflected margins, and expanded stamens.
2. Half of the staminal tube, viewed from within, to show the inner rows of capillary sterile short filaments, the more exterior series being longer and fertile.
3. A longitudinal section of the ovary surmounted by the calycine lobes, disk, and style.
4. A transverse section of the 4-celled ovary.
5. A drupe, of the shape and size described by Hasskahl, a quarter of the pericarp cut away, to show its single suspended seed.
6. The embryo of the seed, with its exhorizal portion beginning to split into 4 sections, as occurs also in Loureiro's specimen of *Doxomma cochinchinense*.
7. A longitudinal section of the same, showing the inner neorhiza ready to germinate.
8. A transverse section of the same.

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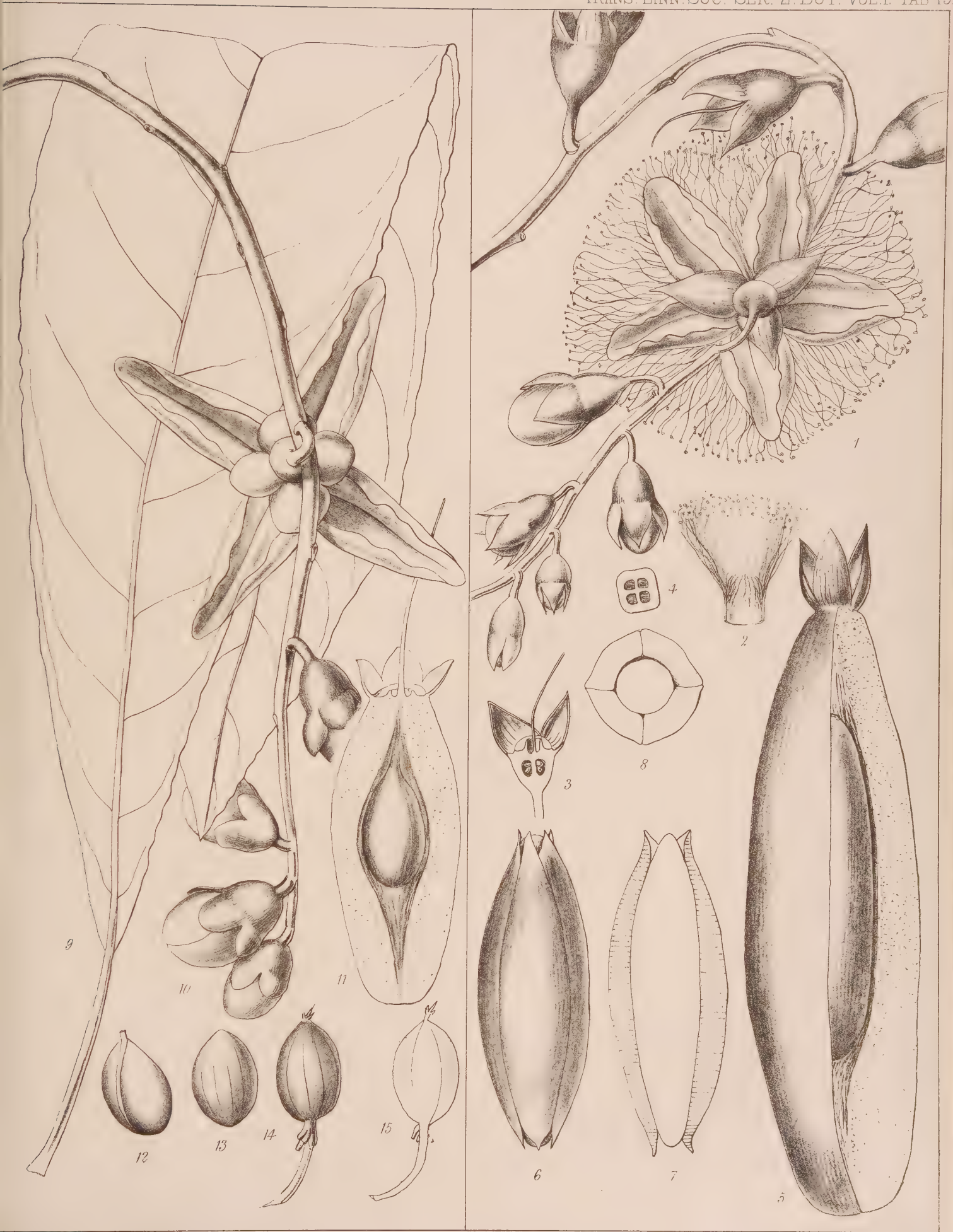
9. A leaf of *Doxommv pendulum*.
10. Portion of a raceme of the same, copied from a drawing of a living specimen, by Parish, with flowers in bud, and another fully expanded, seen from beneath, to show its 4 petals with reflected margins.
11. A fruit of the same, from drawings of Parish and Griffith in his plate 634 A, under *Careya pendula* : seen in longitudinal section, with its single suspended seed.
12. The seed detached.
13. The embryo of the same, the testa being removed.
14. The embryo beginning to germinate.
15. The same germinating, seen in longitudinal section, showing the inner germinating portion (neorhiza) surrounded by the splitting exorhiza, according to the analysis of Griffith : *all nat. size.*

Plate XVI.

Fig. 1. A leaf of *Doxomma cochinchinense* (*Barringtonia acutangula*, Lour.), from Loureiro's original specimen in the British Museum.
2. A fruit of the same, from Loureiro's specimen, with four undulated angles.



Miers, del. D. Blair, Auto-lith.

Maclure & Macdonald Lith. Edin.

DOXOMMA PENDULUM

MEGADENDRON MACROCARPUM

C. Orbiculato.

Careya sphaerica.

s, del. O. Blair, auto-lith.

DOXOMMA COCHINCHINENSI

...rs, del. D. Blair, auto-lith.

STRAVADIUM ACUTANGULUM.

Maclure & Macdonald, Lith.

CHYDENANTHUS EXCELSUS.

3. A transverse section of the same, showing the embryo within the pericarp.
4. The embryo extracted, with the exhorizal portion splitting into 4 sections.
5. The same, seen in transverse section: *all nat. size.*

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6. A leaf of *Careya orbiculata* from Griffith's specimen.
7. A flower, in bud, of the same.
8. The ovary of the same, from which the petals and stamens have fallen.

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9. The ovary of *Careya sphærica,* crowned by its 4 sepals and style.
10. The monadalphous stamens, with the tube cut open, to show that the more external and more internal series of filaments are capillary and without anthers, the intermediate series alone being fertile: one of the four petals remains attached by its claw to the tube.
11. A longitudinal section of the ovary, showing two of its four cells, two of the sepals, the epigynous disk, on the outer margin of which the staminal tube was seated, the inner margin being raised, leaving a hollow in the vertex round the base of the style.
12. A transverse section of the same.
13. A drupe, crowned by the persistent sepals and style, a quarter of its pericarp being cut away to show the seeds imbedded in pulp, the latter having been removed.
14. One of the seeds.
15. The same, after germination, copied from Dr. Thomson's drawing: the neorhiza has sprouted into a rootlet at one extremity, while at the other it has thrown out a long naked stemlet, crowned at its apex by 4 young decussating leaves: *all nat. size.*

Plate XVII.

Stravadium acutangulum, DC.

Figs. 1 & 2. Drawing taken from the typical specimens of a Ceylon plant in the herbarium of Hermann, upon which Linnæus established his *Eugenia acutangula* and Gaertner his *Barringtonia acutangula,* with which numerous other species have been confounded.

3. A flower of the same, in bud.
4. The same, full-grown and expanded.
5. The ovary crowned by the calyx: *all nat. size.*
6. The same: *magnified.*
7. A longitudinal section of the same.
8. The staminal tube cut open, showing the stamens and two of its four petals agglutinated to it by their claws, all having fallen off from their attachment to the disk.
9. A transverse section of the ovary, showing it to be only 2-celled: *all equally magnified.*
10. The fruit, from Gaertner's drawing.
11. The same, with half of the pericarp removed, to show the enclosed seed.
12. The embryo of the seed.
13. A longitudinal section of the same, showing the neorhiza enclosed in the exorhiza.
14. A transverse section of the same, showing the exhorhizal portion splitting into 4 sections: *all nat. size.*

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15. A portion of the plant of *Chydenanthus excelsus,* with its branching panicle, upon which an expanded flower is seen.
16. A flower in bud.

17. The cup-shaped calyx, with a truncated margin: *all nat. size.*
18. The monadelphous tube of the stamens, cut open, to show the inner row of short sterile filaments, the whole having fallen from the inner margin of the disk.
19. A longitudinal section of the ovary, crowned by the calyx, disk, and style.
20. A transverse section of the same, showing it to have only 2 cells: *the last three figures are somewhat magnified.*

Plate XVIII.

Fig. 1. A portion of the flowering specimen of *Planchonia crenata,* from Mr. Robert Brown's typical specimen in the British Museum; the branching panicle shows a flower in bud and another fully expanded.

2. The stamens united into a monadelphous tube, upon which one of the four petals remains, to show how they are agglutinated to it by their claws, the tube having fallen from its attachment to the outer margin of the disk.
3. The ovary, surmounted by the sepals and style.
4. A longitudinal section of the same, showing two of its four cells, and surmounted by the sepals, disk, and style.
5. A transverse section of the same, showing its 4 cells.
6. The drupe, drawn from Mr. Brown's specimen.
7. A longitudinal section of the same, crowned by the persistent sepals, disk, and style, and showing two of the four cells, with the seeds as they exist *in situ,* the pulp being removed.
8. A longitudinal section of another fruit, collected by Schomburgk; this is gibbous, owing to the abortion of three of its cells, and it contains 4 seeds, horizontally attached to the axis, and apparently once imbedded in pulp, as in the preceding specimen.
9. One of the seeds, on its short thick funicle.
10. The same, deprived of its membranaceous integument and funicle, showing a depressed hollow on one side below the apex: seen on its face.
11. The same, viewed on its edge.
12. A longitudinal section of the same, seen from the interior of one of the faces, from which the loose embryo has been removed: it is an envelope of thick firm texture, opaquely white, seeming like an albumen.
13. The embryo extracted: *all nat. size.*
14. The same, *magnified,* showing the thick subtruncated terete radicle, upturned suddenly near the base, and supporting the two roundish fleshy subplicated cotyledons.
15. An edge view of the same: *equally magnified.*

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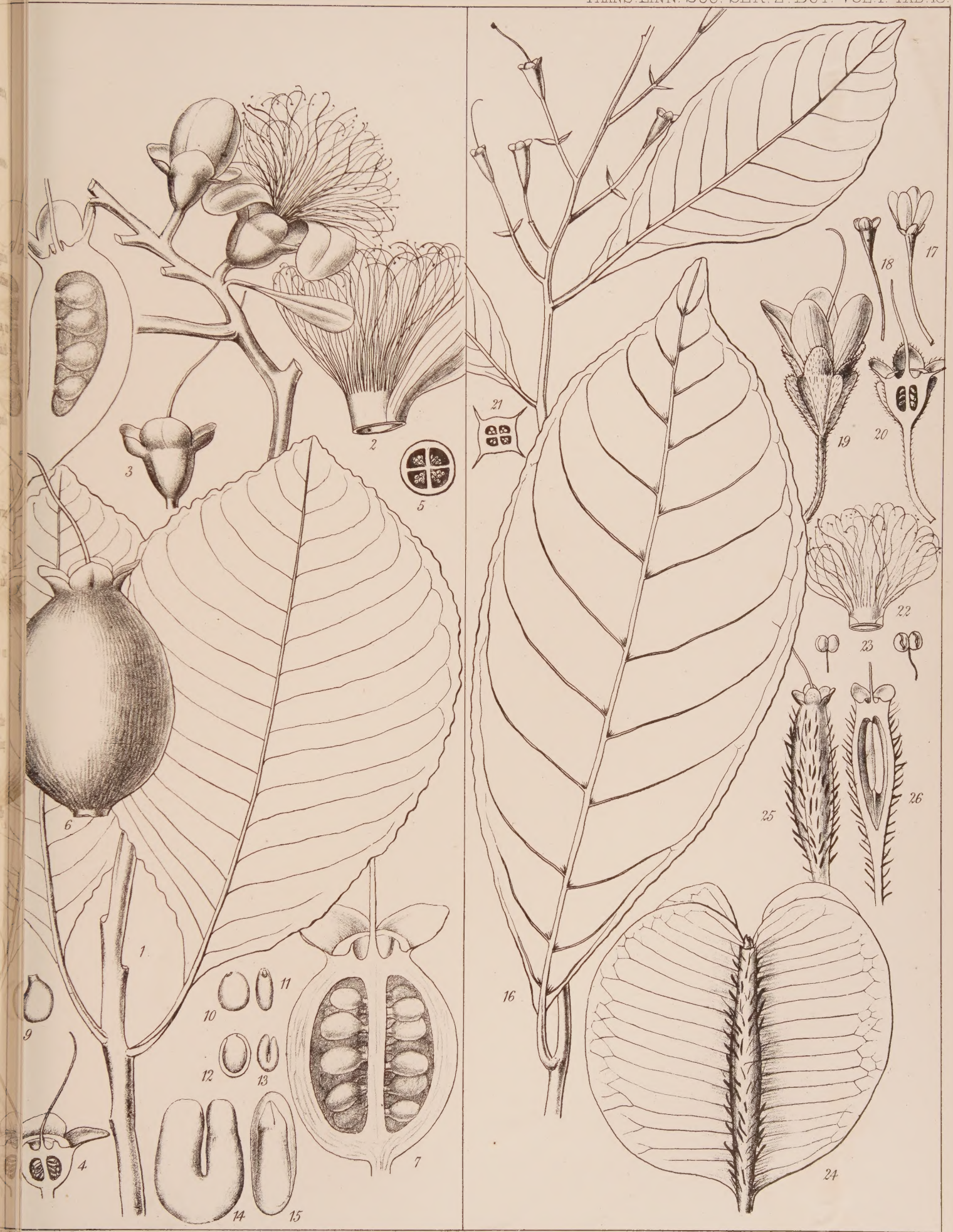
16. A portion of a plant of *Petersia africana,* from a specimen given to me by Dr. Welwitsch.
17. A flower on its pedicel.
18. The ovary and calyx, the petals and stamens having been removed: *all nat. size.*

19 is an enlarged view of fig. 17, showing its 4-winged inferior ovary, crowned by the 4 sepals alternate with the wings and the 4 petals.

20. A longitudinal section of the ovary, disk, and style.
21. A transverse section of fig. 20.
22. The monadelphous stamens detached from the outer margin of the disk: *all magnified.*
23. An anther, seen before and behind: *more magnified.*
24. A fruit, with its 4 large membranaceous wings.
25. The pericarp of the same, deprived of its wings.
26. A longitudinal section of the same: *all nat. size.*



L. Delliers del. D. Blair, Autolith.

PLANCHONIA CRENATA.

Maclure & Macdonald, Lith. London.

PETERSIA AFRICANA.